Rockwell
International

instruction book
(repair manual)

Collins General Aviation Division

Collins ALT-50 Radio Altimeter System

Collins ALT-50A Radio Altimeter Receiver-Transmitter

Collins 339H-4/4A Radio Altitude Indicator

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TO: HOLDERS OF COLLINS ALT-50 RADIO ALTIMETER SYSTEM INSTRUCTION BOOK
(523-0766818)

THIRD EDITION HIGHLIGHTS

The attached publication completely replaces the existing book. This revision updates and corrects minor errors found in the previous edition. New, supplemental, and revised material has been added in a manner that does not destroy information needed for servicing earlier model equipment. Added to this edition is an appendix section that includes IC descriptions of IC's used in the ALT-50.

This edition does not include copies of the Service Bulletins (SB), and Service Information Letters (SIL) for this product. A listing of all SB's/SIL's issued to date is on the Bulletins section title page (purple page) of this book. All of the SB's and SIL's have been incorporated in the various sections of the book as applicable. Pull your copies of ALT-50 SB's and SIL's from your old book and place them behind the Bulletins section title page in this book.

Portions of this book that have been revised are marked with a black bar in the margin. Retain this letter of transmittal for future reference.

PUBLICATIONS DEPARTMENT

•523-0766818-00311A
3rd Edition, 15 January 1988

Rockwell
International

instruction book
(repair manual)

Collins ALT-50
Radio Altimeter System

(With ALT-50A for 2000-Foot Operation)

This publication includes:	
ALT-50 Radio Altimeter System	
Description	*523-0766819*
Installation	*523-0766820*
Operation	*523-0766821*
Theory	*523-0766822*
Maintenance	*523-0766823*
Diagrams	*523-0766824*
Bulletins	*523-0766825*
Appendix	*523-0775224*
339H-4/4A Radio Altitude Indicator	
Description	*523-0764965*
Maintenance	*523-0764891*
Diagrams	*523-0764964*
Parts List	*523-0764946*
Bulletins	*523-0775347*
Appendix	*523-0775278*

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Caution

The material in this manual is subject to change. Before attempting any maintenance operation on the equipment covered in this manual, verify that you have complete and up-to-date publications by referring to the applicable Publications and Service Bulletin Indexes.

We welcome your comments concerning this publication. Although every effort has been made to keep it free of errors, some may occur. When reporting a specific problem, please describe it briefly and include the publication part number, the paragraph or figure number, and the page number.

Send your comments to: Publications Department
Collins General Aviation Division
Rockwell International Corporation
Cedar Rapids, Iowa 52498

Collins ALT-50 Radio Altimeter System (With ALT-50A for 2,000-Foot Operation)

Rockwell
International

description

Collins General Aviation Division

Printed in USA

523-0766819-006118
6th Edition, 15 January 1988

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NOTICE: This section replaces fifth edition dated 15 January 1985.

List of Effective Pages

*The asterisk indicates pages changed, added, or deleted by the current change.

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1-14 thru 1-15	15 Jan 85
*1-16	15 Jan 88

Record of Revisions

RETAIN THIS RECORD IN THE FRONT OF MANUAL.
ON RECEIPT OF REVISIONS, INSERT REVISED PAGES IN THE MANUAL,
AND ENTER DATE INSERTED AND INITIALS.

REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED	REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED
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5th Ed	15 Jan 85		ALT-50A SB 2				
6th Ed	15 Jan 88		None				

section I

description

1.1 GENERAL

The ALT-50 Radio Altimeter System (figure 1-1) is a lightweight, low-profile altimeter system designed specifically for installation in light and medium, fixed-wing aircraft. The system is also used in helicopters.

1.2 PURPOSE OF EQUIPMENT

The ALT-50 Radio Altimeter System provides the pilot with dependable and accurate altitude indications during the critical approach phase of the flight. The system supplies altitude information to the flight control (autopilot) system during the approach phase. The pilot manually selects a decision height and the system alerts the pilot when the aircraft descends to the selected decision height.

1.3 EQUIPMENT SUPPLIED

One ALT-50 Radio Altimeter System consists of an ALT-50A Radio Altimeter Receiver-Transmitter, a 339H-4/4A Radio Altitude Indicator, two 437X-1/1A/1B or ANT-50A/51A/52 Antennas, and a UMT-12 Mount or 390R-19 Mounting Tray. (To protect the wiring at the rear of the UMT-12, an optional connector housing kit, CPN 621-8533-002, is recommended. To protect the wiring at the rear of the 390R-19, an optional connector housing kit, CPN 621-8533-002, is recommended.) Table 1-1 lists the equipment available and their differences.

The DRI-55 Digital Radio Altitude Indicator is available for use with the ALT-50 system. The DRI-55 is not required in the ALT-50 system but is an option that provides a digital altitude display. Refer to the DRI-55 Digital Radio Altitude Indicator Instruction Book, CPN 523-0768424.

Specific units in the FIS-85 Flight Instrument System and EFIS-85( )/86( ) Electronic Flight Instrument System can be used in place of the 339H-4/4A and DRI-55 to display and set radio altitude information. Refer to the FIS-85 Flight Instrument System Instruction Book, CPN 523-0769518, and the EFIS-85A-2a/85A(1) Electronic Flight Instrument System Instruction Book, CPN 523-0773337, for additional information.

1.4 EQUIPMENT REQUIRED BUT NOT SUPPLIED

Two RG-214/U coaxial cables are required to connect the ALT-50A to its associated 437X-1/1A/1B or ANT-50A/51A/52 Antennas. Each cable must not exceed 5.18 m (17 ft) in length. Four type TNC male connectors are required to connect the cables from the antennas to the ALT-50A. Also required but not supplied is the mating connector for the ALT-50A, CPN 618-1657-001, the mating connector for the 399H-4/4A, CPN 371-8087-000, or the mating connector for the DRI-55, CPN 371-0221-000.

1.5 SPECIFICATIONS

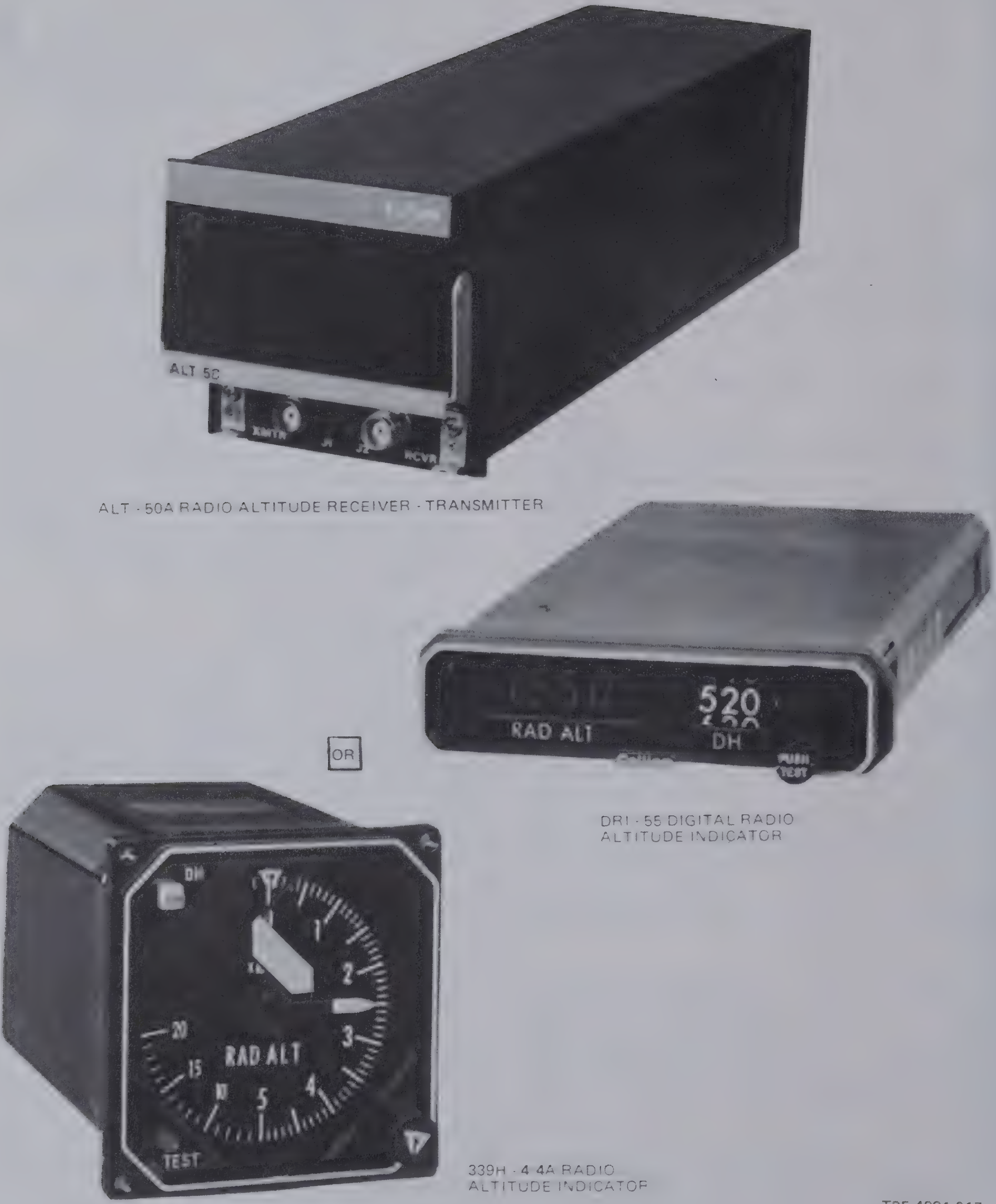
Table 1-2 is a list of specifications for the ALT-50 Radio Altimeter System. Table 1-3 lists the specifications for the ALT-50A Radio Altimeter Receiver-Transmitter. Table 1-4 lists the specifications for the 437X-1/1A/1B Antenna, table 1-5 lists the specifications for the ANT-50A Antenna, table 1-6 lists the specifications for the ANT-51A Antenna, table 1-7 lists the specifications for the ANT-52 Antenna, and table 1-8 lists the specifications for the DRI-55 Digital Radio Altitude Indicator. Refer to description section (CPN 523-0764965) in this instruction book for the 339H-4/4A Radio Altitude Indicator specifications.

1.6 PHYSICAL DESCRIPTION

The ALT-50 Radio Altimeter System using a 339H-4/4A Radio Altitude Indicator and two 437X-1/1A/1B or ANT-50A/51A/52 Antennas weighs 4.0 kg (8.8 lb) maximum, excluding interconnect wiring.

Aircraft installation delay (AID) adjustments are provided for 20, 40, and 57 ft.

The system provides four shop-adjustable altitude trips. The trips can be adjusted to any altitude between 0 and 2,000 ft. The trips are factory set to 200, 500, 1,000, and 1,500 ft.


ALT 50
XMTR
J1
J2
RCVR
520
RAD ALT
DH
PUSH TEST
DH
RAD ALT
TEST
1
2
3
4
5
10
15
20

ALT - 50A RADIO ALTITUDE RECEIVER - TRANSMITTER

DRI - 55 DIGITAL RADIO ALTITUDE INDICATOR

OR

339H - 4 4A RADIO ALTITUDE INDICATOR

TP5-4091-017

ALT-50 Radio Altitude System (With ALT-50A for 2000-Foot Operation)
Figure 1-1

ADDENDUM 3
FOR
ALT-50 RADIO ALTIMETER SYSTEM (With ALT-50A for 2000-Foot Operation) INSTRUCTION BOOK (REPAIR MANUAL)

PART NUMBER 523-0766818, DATED 15 JANUARY 1988

Insert this addendum facing page 6-21 of the
ALT-50 Radio Altimeter System Diagrams section of the manual.

NOTE

This addendum supercedes addendum 2. Addendum 2 wrongly referred to capacitor C43 instead of C4.

This addendum is issued to correct the Collins part number for the second entry of capacitor C4 in the PARTS LIST for TRANSMITTER A5 (PART NUMBER 629-7152-001) LATEST EFFECTIVITY: REV H. This parts list is located on the apron of the *P/O Modulator A3, Transmitter A5, Mixer A7, and Delay Line A8, Schematic diagram, Figure 6-11.*

The Collins part number for the second entry for C4 (the one shown as 917-0501-160) should read as follows (changes are underlined and bold):

C4 part number should read 917-0501-**150**.

(The remainder of the parts list is unchanged.)

The next revision to the instruction book (repair manual) will correct the error shown in the parts list

ADDENDUM 4
FOR
ALT-50 RADIO ALTIMETER SYSTEM (With ALT-50A for 2000-Foot Operation) INSTRUCTION BOOK (REPAIR MANUAL)

PART NUMBER 523-0766818, DATED 15 JANUARY 1988

Insert this addendum facing page 2-2 of the
ALT-50 Radio Altimeter System Installation section of the manual.

This addendum is issued to revise note 7 on the interconnect diagram (figure 2-1, sheet 1 of 2) to specify the length of the antenna coax. A paragraph is also added that specifies the length of the antenna coax.

Note 7 of figure 2-1 on page 2-2 should read as follows (changes are in bold type):

"USE OF CABLE THAT DOES NOT CONFORM TO MIL-SPEC STANDARDS FOR RG-214/U WILL AFFECT THE ALT-50 SYSTEM PERFORMANCE RESULTING IN ERRATIC READINGS AND INTERMITTENT OPERATION. **TWO COAXIAL CABLES ARE REQUIRED TO CONNECT THE ALT-50A TO ITS ASSOCIATED 437X-1/1A/1B OR ANT-50A/51A/52 ANTENNAS. LENGTH OF EACH CABLE MUST NOT EXCEED 5.18 m (17 ft).**"

ADDENDUM 4
FOR
ALT-50 RADIO ALTIMETER SYSTEM (With ALT-50A for 2000-Foot Operation) INSTRUCTION BOOK (REPAIR MANUAL)

PART NUMBER 523-0766818, DATED 15 JANUARY 1988

Insert this addendum facing page 2-3 of the
ALT-50 Radio Altimeter System Installation section of the manual.

This addendum is issued to revise note 7 on the interconnect diagram (figure 2-1, sheet 1 of 2) to specify the length of the antenna coax. A paragraph is also added that specifies the length of the antenna coax.

Paragraph 2.3.2 on page 2-3 should read as follows:

2.3.2 Antenna Cables

Two coaxial cables are required to connect the ALT-50A to its associated 437X-1/1A/1B or ANT-50A/51A/52 antennas. Length of each cable must not exceed 5.18 m (17 ft). Four type TNC male connectors are also required to connect the cables from the antennas to the ALT-50A.

ADDENDUM 1
FOR
ALT-50 RADIO ALTIMETER SYSTEM (With ALT-50A for 2000-Foot Operation) INSTRUCTION BOOK (REPAIR MANUAL)

PART NUMBER 523-0766818, DATED 15 JANUARY 1988

Insert this addendum facing page 5-42 of the
ALT-50 Radio Altimeter System Maintenance section of the manual.

This addendum is issued to correct an error shown on *Modulator A3, Oscillator Adjustment, Test Setup Figure 5-10.*

The identifiers for connectors A5J1 and A5J2 in the upper portion of figure 5-10 are shown reversed. The identifier for the upper connector (the one with the 'DELAY LINE COAX' connected to it) should be identified as **A5J2**. The identifier for the lower connector (the one with the '20 DB XMTR LOAD' connected to it) should be identified as **A5J1**.

The next revision to the instruction book (repair manual) will correct the errors shown on figure 5-10.

ADDENDUM 2
FOR
ALT-50 RADIO ALTIMETER SYSTEM (With ALT-50A for 2000-Foot Operation) INSTRUCTION BOOK (REPAIR MANUAL)

PART NUMBER 523-0766818, DATED 15 JANUARY 1988

Insert this addendum facing page 6-21 of the
ALT-50 Radio Altimeter System Diagrams section of the manual.

This addendum is issued to correct the Collins part number for the second entry of capacitor C43 in the PARTS LIST for TRANSMITTER A5 (PART NUMBER 629-7152-001) LATEST EFFECTIVITY: REV H. This parts list is located on the apron of the *P/O Modulator A3, Transmitter A5, Mixer A7, and Delay Line A8, Schematic diagram, Figure 6-11.*

The Collins part number for the second entry for C43 (the one shown as 917-0501-160) should read as follows (changes are underlined and bold):

C43 part number should read 917-0501-**150**.

(The remainder of the parts list is unchanged.)

The next revision to the instruction book (repair manual) will correct the error shown in the parts list

An adjustable decision height trip is provided in the cockpit to allow the pilot to select a decision height from 0 to 2,000 ft. The pilot selects the decision height by adjusting a DH knob on the front of the indicator, which sets the DH index on the scale dial to the selected altitude.

Table 1-1. Equipment Supplied.

EQUIPMENT TYPE	DESCRIPTION	COLLINS PART NO (CPN)
ALT-50A	Radio altimeter (receiver-transmitter), -20- to +2,000-ft altitude range with 4 altitude trip outputs.	622-3201-001
ALT-50A	Radio altimeter (receiver-transmitter), -20- to +2,000-ft altitude range with 4 altitude trip outputs. (For U.S. Coast Guard MRS Program.)	622-3201-002
339H-4	Radio altitude indicator. -20- to +2,000-ft altitude scale calibrated for fixed-wing aircraft. Gray bezel and +28-V dc blue-white lighting.	622-1204-001
339H-4	Radio altitude indicator. -20- to +2,000-ft altitude scale calibrated for fixed-wing aircraft. Gray bezel and +5-V dc blue-white lighting.	622-1204-002
339H-4	Radio altitude indicator. -20- to +2,000-ft altitude scale calibrated for fixed-wing aircraft. Black bezel and +28-V dc blue-white lighting.	622-1204-003
339H-4	Radio altitude indicator. -20- to +2,000-ft altitude scale calibrated for fixed-wing aircraft. Black bezel and +5-V dc blue-white lighting.	622-1204-004
339H-4	Radio altitude indicator. -20- to +2,000-ft altitude scale calibrated for fixed-wing aircraft. Gray bezel and +28-V dc blue-white lighting.	622-1204-005
339H-4	Radio altitude indicator. -20- to +2,000-ft altitude scale calibrated for fixed-wing aircraft. Gray bezel and +5-V dc blue-white lighting.	622-1204-006
339H-4	Radio altitude indicator. -20- to +2,000-ft altitude scale calibrated for fixed-wing aircraft. Gray bezel and +5-V dc blue-white lighting.	622-1204-007
339H-4	Radio altitude indicator. -20- to +2,000-ft altitude scale calibrated for fixed-wing aircraft. Black bezel and +5-V dc blue-white lighting. (For U.S. Coast Guard MRS Program.)	622-1204-008
339H-4	Radio altitude indicator. -20- to +2,000-ft altitude scale calibrated for fixed-wing aircraft. Black-gray bezel and +5-V dc blue-white lighting.	622-1204-010
339H-4A	Radio altitude indicator. -20- to +2,000-ft altitude scale calibrated for helicopters. Gray bezel and +28-V dc blue-white lighting.	622-1205-001
339H-4A	Radio altitude indicator. -20- to +2,000-ft altitude scale calibrated for helicopters. Gray bezel and +5-V dc blue-white lighting.	622-1205-002
339H-4A	Radio altitude indicator. -20- to +2,000-ft altitude scale calibrated for helicopters. Black bezel and +28-V dc blue-white lighting.	622-1205-003
339H-4A	Radio altitude indicator. -20- to +2,000-ft altitude scale calibrated for helicopters. Black bezel and +5-V dc blue-white lighting.	622-1205-004
339H-4A	Radio altitude indicator. -20- to +2,000-ft altitude scale calibrated for helicopters. Gray bezel and +28-V dc blue-white lighting.	622-1205-005
339H-4A	Radio altitude indicator. -20- to +2,000-ft altitude scale calibrated for helicopters. Gray bezel and +5-V dc blue-white lighting.	622-1205-006

Table 1-1. Equipment Supplied (Cont).

EQUIPMENT TYPE	DESCRIPTION	COLLINS PART NO (CPN)
437X-1	Antenna. Beam width: E-plane, 60 degrees; H-plane, 40 degrees. Gain: 11.5 dB. Mounting surface: flat. Vswr: 1.5:1 max.	522-4140-001
437X-1	Antenna. Beam width: E-plane, 60 degrees; H-plane, 45 degrees. Gain: 11 dB. Mounting surface: flat. Vswr: 1.4:1 max.	522-4140-002
437X-1	Antenna. Beam width: E-plane, 45 degrees; H-plane, 40 degrees. Gain: 12 dB. Mounting surface: flat. Vswr: 1.5:1 max.	522-4140-003
437X-1	Antenna. Beam width: E-plane, 60 degrees; H-plane, 45 degrees. Gain: 11 dB. Mounting surface: flat. Vswr: 1.4:1.	522-4140-004
437X-1	Antenna. Beam width: E-plane, 60 degrees; H-plane, 40 degrees. Gain: 11.5 dB. Mounting surface: flat. Vswr: 1.5:1 max (UBC).	522-4140-006
437X-1	Antenna. Beam width: E-plane, 60 degrees; H-plane, 40 degrees. Gain: 11.5 dB. Mounting surface: flat. Vswr: 1.5:1 max (Dorne-Margolin).	522-4140-007
437X-1A	Antenna. Beam width: E-plane, 50 degrees; H-plane, 40 degrees. Gain: 11.5 dB. Mounting surface: curved. Vswr: 1.5:1 max.	522-4255-001
437X-1A	Antenna. Beam width: E-plane, 60 degrees; H-plane, 45 degrees. Gain: 11 dB. Mounting surface: curved. Vswr: 1.4:1 max.	522-4255-002
437X-1A	Antenna. Beam width: E-plane, 45 degrees; H-plane, 40 degrees. Gain: 12 dB. Mounting surface: curved. Vswr: 1.5:1 max.	522-4255-003
437X-1A	Antenna. Beam width: E-plane, 50 degrees; H-plane, 40 degrees. Gain: 11.5 dB. Mounting surface: curved. Vswr: 1.5:1. Mounting holes offset 22.5 degrees from other 437X-1A Antennas.	522-4255-004
437X-1B	Antenna. Beam width: E-plane, 50 degrees; H-plane, 55 degrees. Gain: 9 dB min. Mounting surface: curved, 81.28-cm (32-in) radius. Vswr: 1.4:1 max.	622-0954-001
437X-1B	Antenna. Beam width: E-plane, 50 degrees; H-plane, 55 degrees. Gain: 9 dB min. Mounting surface: curved, 81.28-cm (32-in) radius. Vswr: 1.4:1 max.	622-0954-002
ANT-50A	Antenna. Beam width: E-plane, 35 degrees; H-plane, 35 degrees. Gain: 13 dB min. Mounting surface: flat. Vswr: 1.3:1 max.	622-3698-001
ANT-51A	Antenna. Beam width; E-plane, 55 degrees; H-plane, 50 degrees. Gain: 11.5 dB min. Mounting surface: flat. Vswr: 1.5:1 max.	622-4550-001
ANT-52	Antenna. Beam width: E-plane, 60 degrees; H-plane, 50 degrees. Gain: 10 dB. Mounting surface: Flat or curved. Vswr: 1.5:1 max.	622-6793-001
UMT-12	Mount, universal.	622-5212-001
390R-19	Mount, universal.	622-1195-301
	OPTIONAL EQUIPMENT	
DRI-55	Digital radio altitude indicator, gray case, and +5-V dc white lighting with linear lighting curve.	622-4160-001
DRI-55	Digital radio altitude indicator, gray case, +28-V dc white lighting with linear lighting curve.	622-4160-002
DRI-55	Digital radio altitude indicator, black case, +5-V dc white lighting with linear lighting curve.	622-4160-003
DRI-55	Digital radio altitude indicator, black case, +28-V dc white lighting with linear lighting curve.	622-4160-004

Table 1-1. Equipment Supplied (Cont).

EQUIPMENT TYPE	DESCRIPTION	COLLINS PART NO (CPN)
DRI-55	Digital radio altitude indicator, gray case, +5-V dc white lighting with linear lighting curve, and DH annunciator.	622-4160-005
DRI-55	Digital radio altitude indicator, gray case, +28-V dc white lighting with linear lighting curve, and DH annunciator.	622-4160-006
DRI-55	Digital radio altitude indicator, black case, +5-V dc white lighting with linear lighting curve, and DH annunciator.	622-4160-007
DRI-55	Digital radio altitude indicator, black case, +28-V dc white lighting with linear lighting curve, and DH annunciator.	622-4160-008
DRI-55	Digital radio altitude indicator, gray case, and +5-V dc white lighting with nonlinear lighting curve.	622-4160-011
DRI-55	Digital radio altitude indicator, gray case, and +28-V dc white lighting with nonlinear lighting curve.	622-4160-012
DRI-55	Digital radio altitude indicator, black case, and +5-V dc white lighting with nonlinear lighting curve.	622-4160-013
DRI-55	Digital radio altitude indicator, black case, and +28-V dc white lighting with nonlinear lighting curve.	622-4160-014
DRI-55	Digital radio altitude indicator, gray case, +5-V dc white lighting with nonlinear lighting curve, and DH annunciator.	622-4160-015
DRI-55	Digital radio altitude indicator, gray case, +28-V dc white lighting with nonlinear lighting curve, and DH annunciator.	622-4160-016
DRI-55	Digital radio altitude indicator, black case, +5-V dc white lighting with nonlinear lighting curve, and DH annunciator.	622-4160-017
DRI-55	Digital radio altitude indicator, black case, +28-V dc white lighting with nonlinear lighting curve, and DH annunciator.	622-4160-018

Table 1-2. System Specifications.

CHARACTERISTIC	SPECIFICATION
Applicable specifications	
TSO	C-87
RTCA document	DO-138, DO-123
FCC rules	Part 87
Environmental specifications	
Operating temperature range	
ALT-50A Radio Altimeter Receiver-Transmitter	-54 to +71 °C (-65 to +160 °F), category AG

Table 1-2. System Specifications(Cont).

CHARACTERISTIC	SPECIFICATION
339H-4/4A Radio Altitude Indicator	-15 to +55 °C (+5 to 131 °F), category D
437X-1/1A/1B Antennas	-54 to +55 °C (-65 to +131 °F), category A
ANT-50A/51A/52 Antennas	-54 to +71 °C (-65 to +160 °F)
Service altitude	
ALT-50A Radio Altimeter Receiver-Transmitter	13,716 m (45,000 ft) maximum, category AG
339H-4/4A Radio Altitude Indicator	15,240 m (50,000 ft) maximum, category D
437X-1/1A/1B Antenna	18,288 m (60,000 ft) maximum, category A
ANT-50A Antenna	13,716 m (45,000 ft) maximum, category A
ANT-51A/52 Antenna	18,288 m (60,000 ft) maximum, category A
Relative humidity	95 percent
Cooling	Convection
Vibration	
ALT-50A Radio Altimeter Receiver-Transmitter	Conforms to DO-138, category JN
339H-4/4A Radio Altitude Indicator	Conforms to DO-138, category P
437X-1/1A/1B and ANT-50A/51A/52 Antenna	Conforms to FAA TSO-C87, category A
Shock	
Operational	6 g
Crash safety	15 g (10 ms duration)
Electrical specifications	
Altitude range	-20 to +2,000 ft
Power requirements	
Primary power	+22 to +34 V dc, 24 W
Indicator display lighting power	
339H-4, CPN 622-1204-001, -003, -005 and 339H-4A, CPN 622-1205-001, -003, -005	+28 V dc ±10% or 26 V ac ±10%, 0.120 A maximum
339H-4, CPN 622-1204-002, -004, -006, -007, -008, -010 and 339H-4A, CPN 622-1205-002, -004, -006	+5 V dc ±10%, 0.460 A maximum
Transmitter output	
Power	210 mW nominal, FMCW
Center frequency	4300 ±15 MHz
Modulation	
Selectable frequency	100 or 105 Hz

Table 1-2. System Specifications (Cont).

CHARACTERISTIC	SPECIFICATION
FM deviation, peak-to-peak	
100-Hz modulation	98.4 MHz
105-Hz modulation	93.7 MHz
Type of service	Continuous
Altitude output	
Analog characteristics	
-20 to +500 ft	20 mV/ft
Above 500 ft	10.4 V +3 mV/ft
Analog output noise	5 mV ac rms maximum at 100 ft or less
Off-scale voltage	+18 ±0.5 V dc
Analog accuracy	±2 ft or ±2%, whichever is greater
Analog time constant	0.09 ±0.01 s
Load capability	1 millimho maximum
System accuracy, pilot's display (with 339H-4/4A)	
0 to 500 ft	±5 ft or ±5%, whichever is greater
500 to 2,000 ft	±7%
FCS warn output	
No warn	+20 to +33 V dc at not greater than 100 mA
Warn	Less than 20 µA
Altitude trip output	
Tripped	Less than +1.5 V dc at not greater than 100 mA
Untripped	Less than 20 µA at not greater than +30 V dc
External decision height output	Isolated pair of relay contacts for switching external circuit
Maximum continuous contact load	100 mA at +28 V dc 500 mA at 5 V ac 250 mA at 26 V ac 100 mA at 115 V ac

Table 1-3. ALT-50A Radio Altimeter Receiver-Transmitter, Equipment Specifications.

CHARACTERISTIC	SPECIFICATION
Related documents	
FAA TSO	C87
RTCA	DO-138, DO-123
ARINC	408
FCC rules	Part 87
Environmental category	DO-138/AG/A/JN/AAAEXXXXX
Physical	
Size	Short, low, 3/8-ATR case
Weight	2.63 kg (5.8 lb) max
Mounting	Rigid mounted using UMT-12 or 390R-19 Mounting Tray
Environmental	
Temperature range	
Operating	-54 to +71 °C (-65 to +160 °F)
Storage	-62 to +71 °C (-80 to +160 °F)
Service ceiling	13,716 m (45,000 ft) max
Absolute pressure	Equivalent to 127 cm (50 in) of mercury without damage
Cooling	Convection
Relative humidity	95% maximum at +50 ±3 °C (+122 ±5.4 °F) for 6 hours in 48-hour exposure
Shock, rigid mount	
Operating	6 g
Crash safety	15 g (10 ms duration)
Electrical	
Altitude range	-20 to +2,000 ft
Altitude accuracy	
0 to 2,000 ft	±2 ft or ±2%, whichever is greater
Power requirements	+22 to +34 V dc, 24 W (+28 V dc nominal)
Transmitter output	
Rf power	210 mW nominal
Center frequency	4300 ±15 MHz
Modulation	
Frequency	100 or 105 Hz (selectable)

Table 1-3. ALT-50A Radio Altimeter Receiver-Transmitter, Equipment Specifications (Cont).

CHARACTERISTIC	SPECIFICATION
Deviation	
100-Hz frequency	98.4 MHz
105-Hz frequency	93.7 MHz
Type of service	Continuous
Altitude signal output	
Dc analog signal	0 to +18 V dc, piecewise linear
Analog	
-20 to +500 ft	20 mV/ft
+500 to +2,000 ft	10.4 V dc +3 mV/ft
Off-scale voltage	+18 ±0.5 V dc
Load capability	1 millimho maximum
Time constant	0.09 ±0.01 s
Reference voltage outputs	
Positive reference voltage	+22 V dc ±0.5%, regulated
Negative reference voltage	-15 V dc,±0.5%, regulated
DH supply	+27.5 V dc ±10%
Flight control system (FCS) warn output	
No warn	+20 to +33 V dc at 100 mA max
Warn	Less than 20 µA
Altitude trip outputs	
Tripped	Less than +1.5 V dc at 100 mA max
Untripped	Less than 20 µA at 30 V dc max

Table 1-4. 437X-1/1A/1B Antenna, Equipment Specifications.

CHARACTERISTIC	SPECIFICATION
Related documents	
TSO	C87
RTCA documents	DO-138, DO-123
FCC rules	Part 87
EUROCAE	MPS1/WG6/74
EUROCAE	ED-30
ARINC	552
Environmental	TSO-C87, categories
437X-1/1A	AAAAAE
437X-1B	AAAAAX
Physical	
Size	
Flange diameter	17.78 cm (7 in)
Body diameter	13.21 cm (5.2 in)
Height	6.99 cm (2.75 in)
Weight	0.45 kg (1.0 lb) nominal
Environmental	
Temperature	
Operating	-54 to +55 °C (-65 to +131 °F)
Nonoperating	-62 to +85 °C (-80 to +185 °F)
Humidity	0 to 100% with condensation at +50 °C (+122 °F)
Altitude	0 to 18,288 m (0 to 60,000 ft)
Vibration	
5 to 10 Hz (437X-1/1A)	0.1016-cm (0.040-in) double amplitude
5 to 10 Hz (437X-1B)	0.2032-cm (0.080-in) double amplitude
10 to 55 Hz (437X-1/1A)	0.07620-cm (0.030-in) double amplitude
10 to 55 Hz (437X-1B)	0.1520-cm (0.060-in) double amplitude
55 to 500 Hz	10 g
500 to 1000 Hz	6 g
Shock	6 g for 10 ms
Pressure differential	0.907 kg/cm^2 (12.9 lb/in^2)
Electrical	
Gain	
437X-1 (522-4140-002, -004) 437X-1A (522-4255-002)	11 dB minimum
437X-1 (522-4140-001) 437X-1A (522-4255-001, -004)	11.5 dB minimum
437X-1 (522-4140-003) 437X-1A (522-4255-003)	12 dB minimum
437X-1B (622-0954-001, -002)	9 dB minimum

Table 1-4. 437X-1/1A/1B Antenna, Equipment Specifications (Cont).

CHARACTERISTIC	SPECIFICATION
Beam width	
437X-1 (522-4140-003) 437X-1A (522-4255-003)	E-plane 45 ±5°, H-plane 40° +10°, -5°
437X-1 (522-4140-001) 437X-1A (522-4255-001, -004)	E-plane 50 ±5°, H-plane 40° +10°, -5°
437X-1 (522-4140-002, -004) 437X-1A (522-4255-002)	E-plane 60 ±5°, H-plane 45° +10°, -5°
437X-1B (622-0954-001, -002)	E-plane 50 ±5°, H-plane 55 ±5°
Squint angle	6° maximum
Isolation	
91.44-cm (36-in) spacing (437X-1 (522-4140-002, -003, -004)) (437X-1A (522-4255-002, -003))	90 dB minimum
76.2-cm (30-in) spacing (437X-1B (all))	85 dB minimum
50.8-cm (20-in) spacing (All)	80 dB minimum
Input impedance	50 Ω nominal
Frequency range	4250 to 4350 MHz
Vswr	
437X-1 (522-4140-002, -004) 437X-1A (522-4255-002) 437X-1B (622-0954-001, -002)	1.4:1 maximum
437X-1 (522-4140-001, -003) 437X-1A (522-4255-001, -003, -004)	1.5:1 maximum
Mounting	
437X-1	Flat surfaces, in line or side by side
437X-1A	Curved surfaces, in line only; 181.610-cm (71.5-in) nominal radius
437X-1B	For curved surfaces, 81.28-cm (32-in) radius, in line only
Minimum spacing	50.8 cm (20 in)
Connectors	Integral part of antenna unit; type TNC, female
Mating connector	CPN 357-7204-010
Orientation	Must be perpendicular to a line between antennas for minimum crosscoupling

Table 1-5. ANT-50A Antenna, Equipment Specifications.

CHARACTERISTIC	SPECIFICATION
Related documents	
TSO	C87
RTCA documents	DO-160
FCC rules	Part 87
Environmental	TSO-C87, categories AAAAAX
Physical	
Size	
Rectangular flange size	15.87 cm (6.2 in) by 14.17 cm (5.6 in)
Body size	14.66 cm (5.77 in) by 12.96 cm (5.1 in)
Height	6.35 cm (2.5 in)
Weight	0.45 kg (1.0 lb) maximum
Environmental	
Temperature	
Operating	-54 to +71 °C (-65 to +160 °F)
Nonoperating	-62 to +71 °C (-80 to +160 °F)
Humidity	0 to 100% with condensation at +50 °C (+122 °F)
Altitude	0 to 13,716 m (0 to 45,000 ft)
Vibration	
10 to 55 Hz	0.07620-cm (0.030-in) double amplitude
55 to 500 Hz	5 g
Shock	6 g for 10 ms
Electrical	
Gain	13 dB minimum
Beam width	E-plane 35° minimum, H-plane 35° minimum
Squint angle	6° maximum
Isolation	
91.44-cm (36-in) spacing	85 dB minimum
50.8-cm (20-in) spacing	80 dB minimum
Input impedance	50 Ω nominal
Frequency range	4210 to 4390 MHz
Vswr	1.3:1 maximum from 4250 to 4350 MHz, 1.4:1 maximum from 4210 to 4390 MHz
Mounting	Flat surfaces, in line or side by side
Minimum spacing	50.8 cm (20 in)
Connectors	Integral part of antenna unit; type TNC, female
Mating connector	CPN 357-7204-010
Orientation	Must be perpendicular to a line between antennas for minimum crosscoupling.

Table 1-6. ANT-51A Antenna, Equipment Specifications.

CHARACTERISTIC	SPECIFICATION
Related documents	
TSO	C87
RTCA documents	DO-160
FCC rules	PART 87
Environmental	TSO-C87, categories AAAAAX
Physical	
Size	
Diameter	17.78 cm (7.0 in)
Height	4.65 cm (1.83 in)
Weight	0.28 kg (0.625 lb) maximum
Environmental	
Temperature	
Operating	-54 to +71 °C (-65 to +160 °F)
Nonoperating	-62 to +71 °C (-80 to +160 °F)
Humidity	0 to 100% with condensation at +50 °C (+122 °F)
Altitude	0 to 18,288 m (0 to 60,000 ft)
Vibration	
5 to 10 Hz	0.1016-cm (0.040-in) double amplitude
10 to 55 Hz	0.07620-cm (0.030-in) double amplitude
55 to 500 Hz	10 g
500 to 1000 Hz	6 g
Shock	15 g for 10 ms
Pressure differential	0.907 kg/cm^2 (12.9 lb/in^2)
Electrical	
Gain	11.5 dB minimum
Beam width	E-plane 55° maximum, H-plane 50° maximum
Squint angle	6° maximum
Isolation	
91.44-cm (36-in) spacing	90 dB minimum
50.8-cm (20-in) spacing	80 dB minimum
Input impedance	50 Ω nominal
Frequency range	4240 to 4360 MHz
Vswr	1.5:1 maximum from 4240 to 4360 MHz
Mounting	Flat surfaces, in line or side by side
Minimum spacing	50.8 cm (20 in)
Connectors	Integral part of antenna unit; type TNC, female
Mating connector	CPN 357-7204-010
Orientation	Must be perpendicular to a line between antennas for minimum crosscoupling.

Table 1-7. ANT-52 Radio Altimeter Antenna, Equipment Specifications.

CHARACTERISTIC	SPECIFICATION		
Related documents			
TSO	C 87		
RTCA document	DO-160		
FCC rules	Part 87		
Environmental	TSO-C87, categories AAAAAX		
Physical			
Size			
Flange (rectangular)	9.27 x 8.89 cm (3.65 x 3.5 in)		
Body	2.54 x 2.54 cm (1.0 x 1.0 in)		
Height	1.85 cm (0.73 in)		
Weight	0.098 kg (3.5 oz) nominal		
Environmental			
Temperature			
Operating (continuous)	-54 to +55 °C (-65 to +131 °F)		
Operating (short term)	Up to +71 °C (+160 °F)		
Storage	-62 to +71 °C (-80 to +160 °F)		
Humidity	0 to 100% with condensation at +50 °C (+122 °F)		
Altitude	0 to 18 288 m (0 to 60 000 ft)		
Vibration			
10 to 80 Hz	0.07620 cm (0.030 in) da		
80 to 500 Hz	10 g peak		
Electrical	GAIN (min)	BEAM WIDTH	
		E-PLANE	H-PLANE
	10 dB	60° +5°, -10°	50° +5°, -10°
Vswr: 4200 to 4400 MHz	2.0:1		
4210 to 4390 MHz	1.9:1		
4240 to 4360 MHz	1.5:1		

Table 1-7. ANT-52 Radio Altimeter Antenna, Equipment Specifications (Cont).

CHARACTERISTIC	SPECIFICATION
Isolation	
91.44 cm (36 in) spacing	95 dB minimum
76.20 cm (30 in) spacing	90 dB minimum
50.8 cm (20 in) spacing	88 dB minimum
40.64 cm (16 in) spacing	80 dB minimum
Input impedance	50 Ω nominal
Mounting	Flat or curved surfaces, in line or side by side, mounting screws supplied
Gasket (optional)	CPN 018-1394-100
Minimum spacing	50.8 cm (20 in)
Connector	Integral part of antenna unit; type TNC, female
Mating connector	CPN 357-7204-010

Table 1-8. DRI-55 Digital Radio Altitude Indicator, Equipment Specifications.

CHARACTERISTIC	SPECIFICATION
Related documents	
FAA TSO	C 87
RTCA	DO-160, environmental categories /A2C1/A/PKS/XXXXXXZBAZZ
Physical	
Size	
Width	85.72 mm (3.375 in)
Height	20.95 mm (0.825 in)
Length	153.41 mm (6.04 in)
Weight	0.32 kg (0.7 lb)
Mounting	
Integral turnlock	The DRI-55 may be front mounted using integral turnlock fasteners in panels 1.27 mm (0.050 in) to 3.18 mm (0.125 in) thick.
Front mount	The DRI-55 may be front mounted using adapter plate (CPN 629-8671-001, gray) or (CPN 629-8671-002, black).
Rear mount	The DRI-55 may be rear mounted using mooring plate (CPN 629-8672-001).

Table 1-8. DRI-55 Digital Radio Altitude Indicator, Equipment Specifications (Cont).

CHARACTERISTIC	SPECIFICATION
Connector	
Type	Cannon
CPN	372-0385-030
Mating connector	Connector block 371-0922-030 DBG-25S-FO and Crimp contacts CPN 371-0946-060 D110238-35
or	
Mating connector	Connector block CPN 371-0221-000 DBM-25S with solder contacts installed
Cooling	Convection
Environmental	
Temperature	
Operating	-20 to +70 °C (-4 to +158 °F)
Storage	-55 to +85 °C (-67 to +185 °F)
Service altitude	12,192 m (40,000 ft)
Humidity	95% at +50 °C (+122 °F)
Shock	
Operational	6 g
Crash safety	15 g (10 ms duration)
Vibration	Categories P, K, and S
Af susceptibility	Category Z
Af magnetic field susceptibility	Category Z
Rfi	Category A
Electrical	
Input voltage	+28 V dc
Input current	0.15 to 0.20 A
Lighting	+5 or +28 V dc

Collins ALT-50 Radio Altimeter System (With ALT-50A for 2,000-Foot Operation)

Rockwell
International

installation

Collins General Aviation Divsion
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NOTICE: This section replaces seventh edition dated 5 June 1986.

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Record of Revisions

RETAIN THIS RECORD IN THE FRONT OF MANUAL.
ON RECEIPT OF REVISIONS, INSERT REVISED PAGES IN THE MANUAL, AND ENTER DATE INSERTED AND INITIALS.

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section II
installation

2.1 GENERAL

Installation data contained in this section consists of preinstallation checks, special cabling procedures and requirements, and removal and installation of the ALT-50A Radio Altimeter Receiver-Transmitter, DRI-55 Digital Radio Altitude Indicator, 339H-4/4A Radio Altitude Indicator, 437X-1/1A/1B or ANT-50A/51A/52 Antennas, UMT-12 Mount, and 390R-19 Mounting Tray. All system components are convection cooled.

An aircraft station radio license is required to operate the ALT-50 Radio Altimeter System. Application for the license should reference the ALT-50A Radio Altimeter Receiver-Transmitter.

2.2 PREINSTALLATION CHECK

2.2.1 ALT-50A Radio Altimeter Receiver-Transmitter

a. Refer to the ALT-50A maintenance section, and perform the minimum performance test procedures.
b. Adjust altitude trips to required altitudes as described in the ALT-50A maintenance section.

2.2.2 339H-4/4A Radio Altitude Indicator

Refer to the 339H-4/4A Radio Altitude Indicator maintenance section and perform the performance test.

2.2.3 437X-1/1A/1B and ANT-50A/51A/52 Antennas

Refer to the 437X-1/1A/1B Antenna Instructions (CPN 523-0769099), ANT-50A Instructions (CPN 523-0769131), or ANT-52 Instructions (CPN 523-0773208), for maintenance and test procedures for the antennas. The ANT-50A procedures also may be used for the ANT-51A Antenna.

2.2.4 DRI-55 Digital Radio Altitude Indicator

Refer to the DRI-55 Digital Radio Altitude Indicator Instruction Book, CPN 523-0768424, and perform the minimum performance test procedures.

2.3 CABLING

2.3.1 Aircraft Wiring Harness Except Antenna Cables

Figures 2-1 and 2-2 are suggested interconnect wiring diagrams for the ALT-50 Radio Altimeter System. The diagrams provide both single and dual installation information. During preparation of the interconnect wiring cables, observe the following precautions:

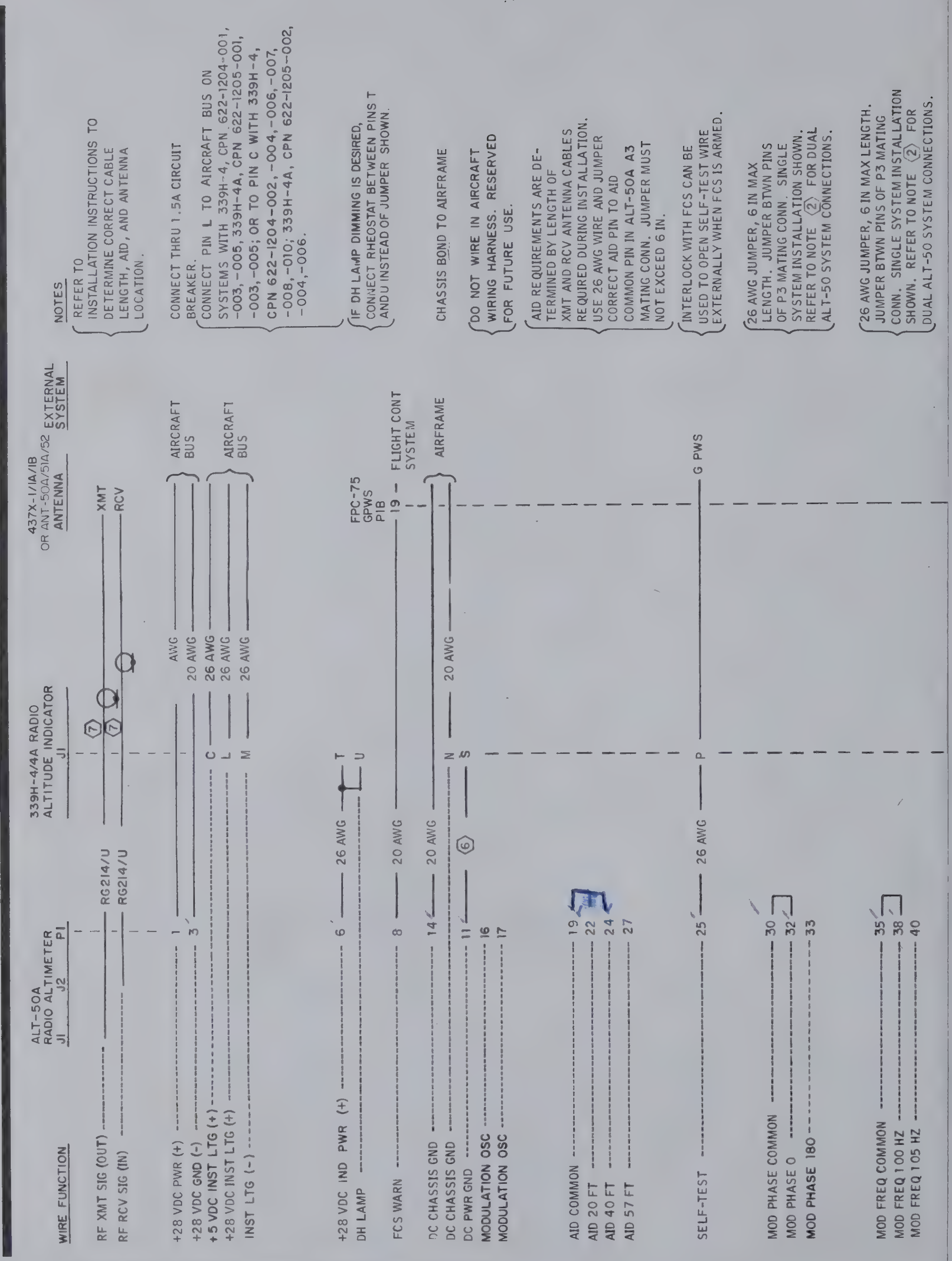
a. Bond and shield all parts of the aircraft electrical system, such as generators and ignition systems.
b. Keep the cables away from circuits carrying heavy current, pulse-transmitting equipment, and other sources of interference.
c. Make all external connections of the equipment through designated connectors listed on the interconnect wiring diagram. Mating connectors are listed on the diagram.
d. Thermoplastic insulated wire is recommended for all connection wires. Wire size is specified on the interconnect wiring diagram.
e. Leave slack in cables to allow for free sway of the equipment.
f. After installation of the cables in the aircraft and before installation of the equipment, a check should be made to ensure that the aircraft power is applied only to the pins specified.
g. Remove and install rear connector contacts as follows:

    1. Installation

Note

The connecting wire must be crimped in the contact so that crimped portion of the contact can enter the connector shell. The crimped portion must enter the shell to provide positive locking of contact in shell.

(a) Using crimping tool (CPN 623-8579-001, preferred; or CPN 372- 8091-070, alternate), crimp each interconnect wire in a contact.
(b) Insert contact in proper connector shell hole and press in until locked. Refer to figure 2-1.


WIRE FUNCTION
RF XMT SIG (OUT)
RF RCV SIG (IN)
+28 VDC PWR (+)
+28 VDC GND (-)
+5 VDC INST LTG (+)
+28 VDC INST LTG (+)
INST LTG (-)
+28 VDC IND PWR (+)
DH LAMP
FCS WARN
DC CHASSIS GND
DC CHASSIS GND
DC PWR GND
MODULATION OSC
MODULATION OSC
AID COMMON
AID 20 FT
AID 40 FT
AID 57 FT
SELF-TEST
MOD PHASE COMMON
MOD PHASE 0
MOD PHASE 180
MOD FREQ COMMON
MOD FREQ 100 HZ
MOD FREQ 105 HZ
ALT-50A RADIO ALTIMETER
J1
J2
P1
1
3
6
8
14
11
16
17
19
22
24
27
25
30
32
33
35
38
40
RG214/U
RG214/U
26 AWG
20 AWG
20 AWG
6
26 AWG
339H-4/4A RADIO ALTITUDE INDICATOR
J1
7
7
C
L
M
T
U
N
S
P
AWG
20 AWG
26 AWG
26 AWG
26 AWG
20 AWG
437X-1/1A/1B OR ANT-50A/51A/52 ANTENNA
XMT
RCV
FPC-75 GPWS P1B
19
EXTERNAL SYSTEM
AIRCRAFT BUS
AIRCRAFT BUS
FLIGHT CONT SYSTEM
AIRFRAME
G PWS

NOTES

REFER TO INSTALLATION INSTRUCTIONS TO DETERMINE CORRECT CABLE LENGTH, AID, AND ANTENNA LOCATION.

CONNECT THRU 1.5A CIRCUIT BREAKER.

CONNECT PIN L TO AIRCRAFT BUS ON SYSTEMS WITH 339H-4, CPN 622-1204-001, -003, -005, 339H-4A, CPN 622-1205-001, -003, -005; OR TO PIN C WITH 339H-4, CPN 622-1204-002, -004, -006, -007, -008, -010; 339H-4A, CPN 622-1205-002, -004, -006.

IF DH LAMP DIMMING IS DESIRED, CONNECT RHEOSTAT BETWEEN PINS T AND U INSTEAD OF JUMPER SHOWN.

CHASSIS BOND TO AIRFRAME

DO NOT WIRE IN AIRCRAFT WIRING HARNESS. RESERVED FOR FUTURE USE.

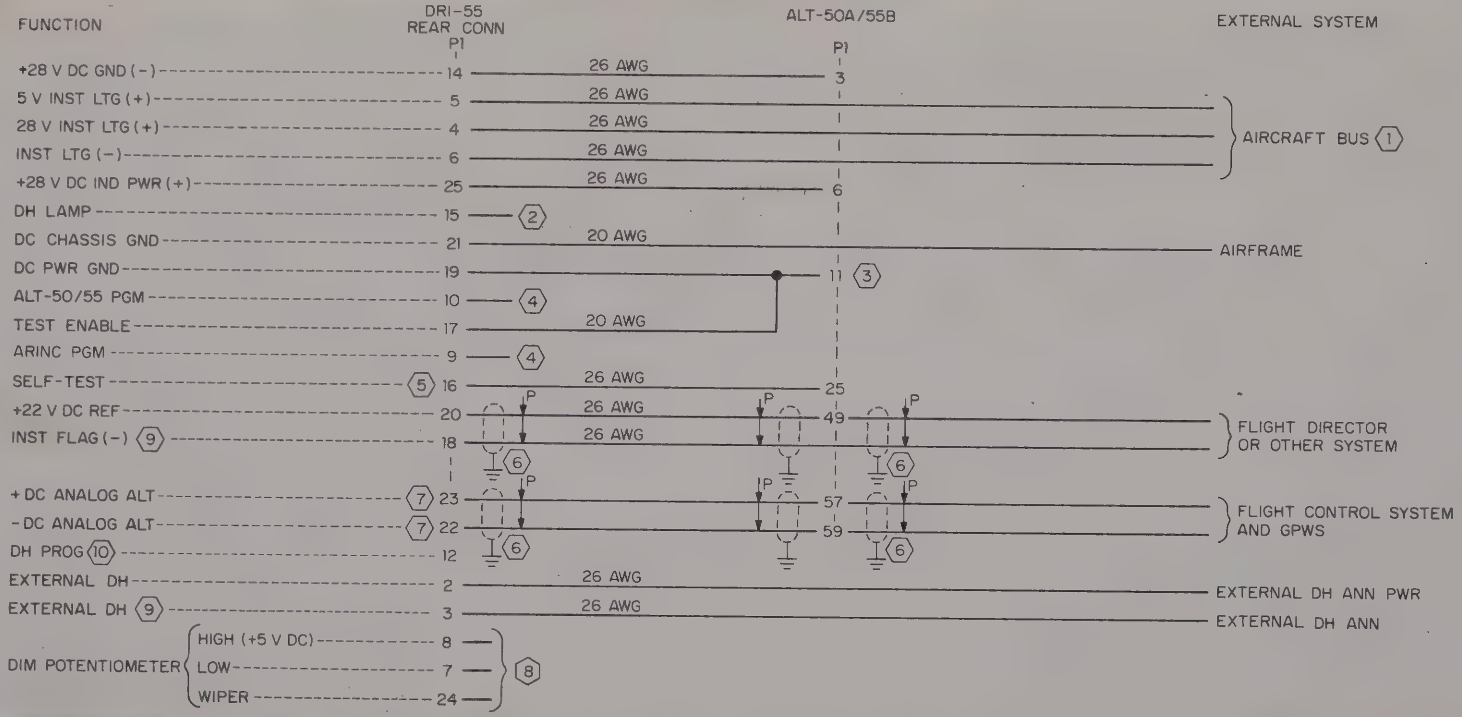
AID REQUIREMENTS ARE DETERMINED BY LENGTH OF XMT AND RCV ANTENNA CABLES REQUIRED DURING INSTALLATION. USE 26 AWG WIRE AND JUMPER CORRECT AID PIN TO AID COMMON PIN IN ALT-50A A3 MATING CONN. JUMPER MUST NOT EXCEED 6 IN.

INTERLOCK WITH FCS CAN BE USED TO OPEN SELF-TEST WIRE EXTERNALLY WHEN FCS IS ARMED.

26 AWG JUMPER, 6 IN MAX LENGTH. JUMPER BTWN PINS OF P3 MATING CONN. SINGLE SYSTEM INSTALLATION SHOWN. REFER TO NOTE ⟨2⟩ FOR DUAL ALT-50 SYSTEM CONNECTIONS.

26 AWG JUMPER, 6 IN MAX LENGTH. JUMPER BTWN PINS OF P3 MATING CONN. SINGLE SYSTEM INSTALLATION SHOWN. REFER TO NOTE ⟨2⟩ FOR DUAL ALT-50 SYSTEM CONNECTIONS.

ALT-50 Radio Altimeter System for 2,000-Foot Operation, Interconnect Wiring Diagram
Figure 2-1 (Sheet 1 of 2)


FUNCTION
DRI-55 REAR CONN P1
ALT-50A/55B P1
EXTERNAL SYSTEM
+28 V DC GND (-) 14 — 26 AWG — 3
5 V INST LTG (+) 5 — 26 AWG
28 V INST LTG (+) 4 — 26 AWG
INST LTG (-) 6 — 26 AWG
+28 V DC IND PWR (+) 25 — 26 AWG — 6
AIRCRAFT BUS ①
DH LAMP 15 ②
DC CHASSIS GND 21 — 20 AWG — AIRFRAME
DC PWR GND 19 — 11 ③
ALT-50/55 PGM 10 ④
TEST ENABLE 17 — 20 AWG
ARINC PGM 9 ④
SELF-TEST ⑤ 16 — 26 AWG — 25
+22 V DC REF 20 — 26 AWG — 49
INST FLAG (-) ⑨ 18 — 26 AWG
FLIGHT DIRECTOR OR OTHER SYSTEM
P
⑥
+DC ANALOG ALT ⑦ 23 — 57
-DC ANALOG ALT ⑦ 22 — 59
FLIGHT CONTROL SYSTEM AND GPWS
DH PROG ⑩ 12
EXTERNAL DH 2 — 26 AWG — EXTERNAL DH ANN PWR
EXTERNAL DH ⑨ 3 — 26 AWG — EXTERNAL DH ANN
DIM POTENTIOMETER
HIGH (+5 V DC) 8
LOW 7
WIPER 24
⑧

DRI-55 Digital Radio Altitude Indicator, Interconnect Wiring Diagram
Figure 2-2

NOTES:

① CONNECT PIN 5 OF DRI

⑨ A SECOND INDICATOR CAN BE OPERATED FROM A SINGLE ALT-50A/55B RADIO ALTIMETER. CONNECT SECOND INDICATOR IN PARALLEL WITH FIRST INDICATOR EXCEPT AS NOTED BELOW OBSERVE DC ANALOG ALTITUDE SIGNAL WIRE RUNS AS SPECIFIED.

- (a) USE ONE INDICATOR OR THE OTHER TO DRIVE A SINGLE EXTERNAL DH ANNUNCIATOR. DO NOT USE BOTH INDICATORS TO DRIVE 1 DH ANN.
- (b) USE ONE INDICATOR OR THE OTHER TO DRIVE INST FLAG IN A SINGLE FLIGHT DIRECTOR SYSTEM, OR OTHER SINGLE SYSTEM.

⑩ FOR DRI-55 UNITS WITH SB-6 GROUNDING P1-12 TO P1-19 WILL KEEP THE DH INDICATOR FUNCTIONAL WHEN THE ALTITUDE READOUT IS 00 FT. WITH NO CONNECTION ON P1-12 THE DH FUNCTION WILL BE DISABLED WHEN THE DISPLAY READOUT IS 00 FT. FOR DRI-55 UNITS WITHOUT SB-6, P1-12 SHOULD BE OPEN.

⑪ ALL REAR CONNECTOR STRAPS SHOULD BE KEPT AS SHORT AS POSSIBLE; PREFERABLY UNDER 75.0 mm [3.0 in].

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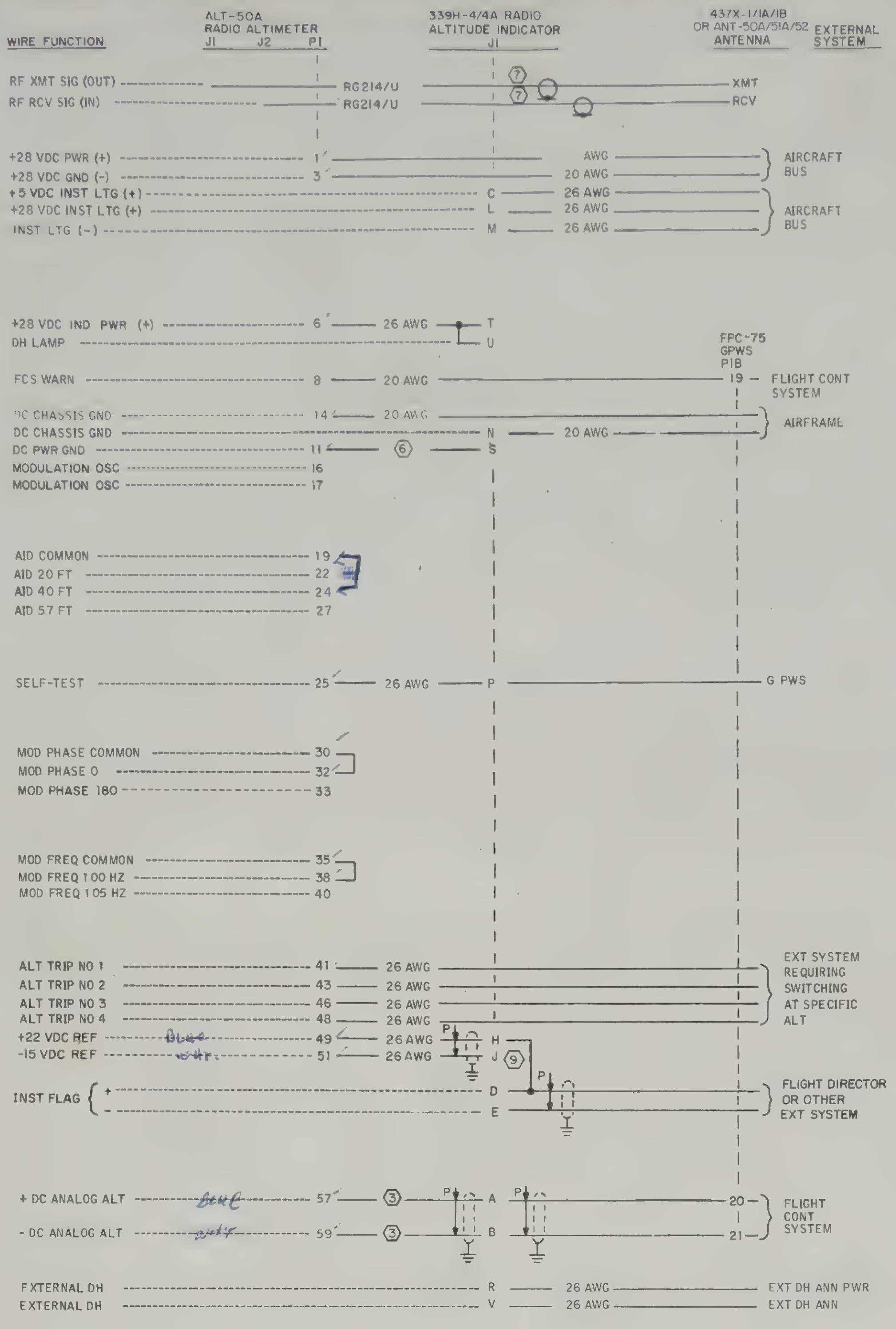

WIRE FUNCTION
ALT-50A RADIO ALTIMETER
J1 J2 P1
339H-4/4A RADIO ALTITUDE INDICATOR
J1
437X-1/1A/1B OR ANT-50A/51A/52 ANTENNA
EXTERNAL SYSTEM
RF XMT SIG (OUT)
RF RCV SIG (IN)
RG214/U
RG214/U
XMT
RCV
+28 VDC PWR (+)
+28 VDC GND (-)
+5 VDC INST LTG (+)
+28 VDC INST LTG (+)
INST LTG (-)
AWG
20 AWG
26 AWG
AIRCRAFT BUS
+28 VDC IND PWR (+)
DH LAMP
FCS WARN
DC CHASSIS GND
DC PWR GND
MODULATION OSC
FPC-75 GPWS P1B
FLIGHT CONT SYSTEM
AIRFRAME
AID COMMON
AID 20 FT
AID 40 FT
AID 57 FT
SELF-TEST
G PWS
MOD PHASE COMMON
MOD PHASE 0
MOD PHASE 180
MOD FREQ COMMON
MOD FREQ 100 HZ
MOD FREQ 105 HZ
ALT TRIP NO 1
ALT TRIP NO 2
ALT TRIP NO 3
ALT TRIP NO 4
+22 VDC REF
-15 VDC REF
EXT SYSTEM REQUIRING SWITCHING AT SPECIFIC ALT
INST FLAG
FLIGHT DIRECTOR OR OTHER EXT SYSTEM
+ DC ANALOG ALT
- DC ANALOG ALT
FLIGHT CONT SYSTEM
EXTERNAL DH
EXT DH ANN PWR
EXT DH ANN

NOTES

REFER TO INSTALLATION INSTRUCTIONS TO DETERMINE CORRECT CABLE LENGTH, AID, AND ANTENNA LOCATION.

CONNECT THRU 1.5A CIRCUIT BREAKER.

CONNECT PIN L TO AIRCRAFT BUS ON SYSTEMS WITH 339H-4, CPN 622-1204-001, -003, -005, 339H-4A, CPN 622-1205-001, -003, -005; OR TO PIN C WITH 339H-4, CPN 622-1204-002, -004, -006, -007, -008, -010; 339H-4A, CPN 622-1205-002, -004, -006.

IF DH LAMP DIMMING IS DESIRED, CONNECT RHEOSTAT BETWEEN PINS T AND U INSTEAD OF JUMPER SHOWN.

CHASSIS BOND TO AIRFRAME

DO NOT WIRE IN AIRCRAFT WIRING HARNESS. RESERVED FOR FUTURE USE.

AID REQUIREMENTS ARE DETERMINED BY LENGTH OF XMT AND RCV ANTENNA CABLES REQUIRED DURING INSTALLATION. USE 26 AWG WIRE AND JUMPER CORRECT AID PIN TO AID COMMON PIN IN ALT-50A A3 MATING CONN. JUMPER MUST NOT EXCEED 6 IN.

INTERLOCK WITH FCS CAN BE USED TO OPEN SELF-TEST WIRE EXTERNALLY WHEN FCS IS ARMED.

26 AWG JUMPER, 6 IN MAX LENGTH. JUMPER BTWN PINS OF P3 MATING CONN. SINGLE SYSTEM INSTALLATION SHOWN. REFER TO NOTE ② FOR DUAL ALT-50 SYSTEM CONNECTIONS.

26 AWG JUMPER, 6 IN MAX LENGTH. JUMPER BTWN PINS OF P3 MATING CONN. SINGLE SYSTEM INSTALLATION SHOWN. REFER TO NOTE ② FOR DUAL ALT-50 SYSTEM CONNECTIONS.

SWITCHES OUTPUT FROM +28 VDC TO GND. 0.1A CAPABILITY. TRIPS ARE SHOP ADJUSTABLE TO ANY ALT BTWN 0 AND 2000 FT. REFER TO ALT-50A RADIO ALTM MAINT SECTION FOR ADJUSTMENT PROC.

GND SHIELD AT ALT-50A ONLY

0.02A LOAD CAPABILITY FOR FLIGHT DIRECTOR SYSTEM AND/OR OTHER EXTERNAL SYSTEM.

1000 OHM TOTAL LOAD CAPABILITY. CONNECT FCS AND/OR ADDITIONAL LOADS DIRECTLY TO ALT-50A.

ISOLATED RELAY CONTACTS CLOSE AT DH AND BELOW

NOTES:

① A SECOND INDICATOR CAN BE OPERATED FROM A SINGLE ALT-50A RADIO ALTIMETER. CONNECT SECOND INDICATOR IN PARALLEL WITH FIRST INDICATOR EXCEPT AS NOTED BELOW. OBSERVE DC ANALOG ALTITUDE SIGNAL WIRE RUNS SPECIFIED IN NOTE 3.

a. USE ONE INDICATOR OR THE OTHER TO DRIVE A SINGLE EXTERNAL DH ANNUNCIATOR. DO NOT USE BOTH INDICATORS TO DRIVE ONE DH ANNUNCIATOR.

b. USE ONE INDICATOR OR THE OTHER TO DRIVE INST FLAG IN A SINGLE FLIGHT DIRECTOR SYSTEM OR OTHER SINGLE SYSTEM.

② WHEN TWO ALT-50 RADIO ALTIMETER SYSTEMS ARE INSTALLED, CONNECT MOD PHASE AND MOD FREQ CONNECTOR PIN AS SHOWN BELOW:

WIRE FUNCTION	WIRE SIZE	ALT-50 SYSTEM NO. 1 ALT-50A CONN P3	ALT-50 SYSTEM NO. 2 ALT-50A CONN P3
MOD PHASE COMMON	NO. 26 AWG	30	30
MOD PHASE 0		32	32
MOD PHASE 180		33	33
MOD FREQ COMMON	NO. 26 AWG	35	35
MOD FREQ 100 HZ		38	38
MOD FREQ 105 HZ		40	40

③ DC ANALOG ALTITUDE WIRE AND MAXIMUM WIRE LENGTHS:

ONE 339H-4/4A = NO. 22 AWG, 65 FEET MAXIMUM (1.0 OHM MAX).
TWO 339H-4/4A = NO 22 AWG FOR RUNS UP TO A MAXIMUM OF 30 FEET OR NO. 20 AWG FOR RUNS UP TO A MAXIMUM OF 50 FT (0.5 OHM MAX).

④ NON STANDARD ABBREVIATIONS:

DH - DECISION HEIGHT
AID - AIRCRAFT INSTALLATION DELAY
FCS = FLIGHT CONTROL SYSTEM
CPN = COLLINS PART NUMBER

⑤ CONNECTORS:

UNIT	CONNECTOR DESIGNATOR	CONNECTOR	MATING CONNECTOR
ALT-50A	J1 AND J2	FRONT PANEL RF CONNECTORS TYPE: TNC FOR RG-214/U	TYPE: TNC MALE STRAIGHT CPN: 357-7204-010 OR TYPE: TNC MALE 90° CPN: 357-7323-020
		TYPE: TNC FOR RG-115A/U	TYPE: TNC MALE STRAIGHT CPN 357-7450-010
	P1	REAR CONNECTOR TYPE: COLLINS THINLINE CPN: 618-1658-001	TYPE: COLLINS THINLINE CPN: 634-1112-001 AND 32 CONNECTOR PINS CPN: 372-2514-010
339H-4	J1	REAR CONNECTOR TYPE: PT02A-14-19P CPN: 371-2051-000	TYPE: PT06A-14-19S CPN: 371-8087-000
339H-4A	J1	REAR CONNECTOR TYPE: KPJ2E14B19MPN CPN: 371-9036-010	TYPE: PT06A-14-19S CPN: 371-8087-000
437X-1/1A/1B OR ANT-50A/51A/52	INTEGRAL PART OF ANTENNA	TYPE: TNC	TYPE: TNC MALE 90° CPN: 357-7204-010 OR TYPE: TNC MALE 90° CPN: 357-7323-020

⑥ ON INSTALLATIONS USING 339H-4/4A. RESISTANCE OF CONNECTING WIRES MUST BE LESS THAN 2.0 OHMS FOR A SINGLE INDICATOR OR LESS THAN 1.0 OHM FOR DUAL INDICATORS. THE FOLLOWING IS A LIST OF WIRE RESISTANCES.

NO. 26 AWG COPPER-25 FT PER OHM
NO. 24 AWG COPPER-40 FT PER OHM
NO. 22 AWG COPPER-62 FT PER OHM
NO. 20 AWG COPPER-100FT PER OHM

⑦ USE OF CABLE THAT DOES NOT CONFORM TO MIL-SPEC STANDARDS FOR RG214/U WILL AFFECT THE ALT-50 SYSTEM PERFORMANCE RESULTING IN ERRATIC READINGS AND INTERMITTENT OPERATION.

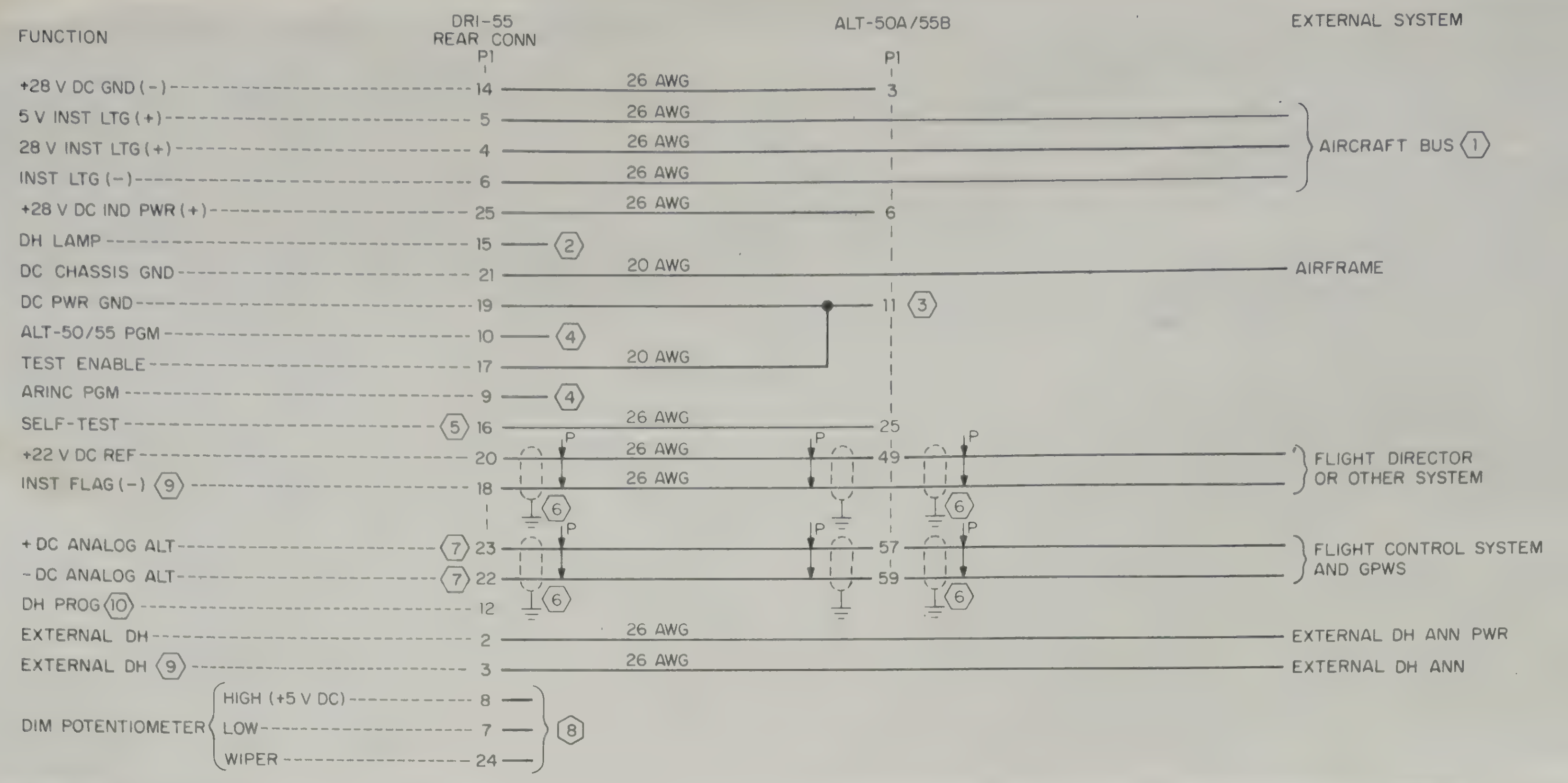
⑧ FOR SIMULTANEOUS OPERATION OF TWO ALTIMETER SYSTEMS, THE RECEIVER-TRANSMITTER UNITS CAN BE EITHER TYPE ALT-50A OR 860F-2, OR THE TYPES CAN BE MIXED.

⑨ GROUND SHIELD TO AIRFRAME AT ONE END ONLY.

⑩ ALL REAR CONNECTOR STRAPS SHOULD BE KEPT AS SHORT AS POSSIBLE; PREFERABLY UNDER 75.0 mm [3.0 in]

TP4-8679-015-0

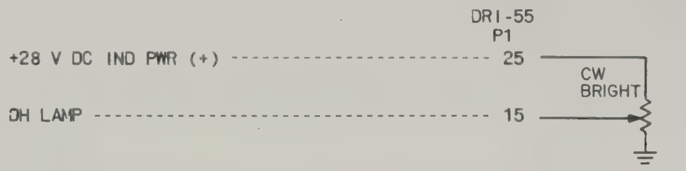
ALT-50 Radio Altimeter System for 2,000-Foot Operation,
Interconnect Wiring Diagram
Figure 2-1 (Sheet 1 of 2)


FUNCTION
DRI-55 REAR CONN P1
ALT-50A/55B P1
EXTERNAL SYSTEM
+28 V DC GND (-) 14 — 26 AWG — 3
5 V INST LTG (+) 5 — 26 AWG
28 V INST LTG (+) 4 — 26 AWG
INST LTG (-) 6 — 26 AWG
AIRCRAFT BUS ①
+28 V DC IND PWR (+) 25 — 26 AWG — 6
DH LAMP 15 ②
DC CHASSIS GND 21 — 20 AWG — AIRFRAME
DC PWR GND 19 — 11 ③
ALT-50/55 PGM 10 ④
TEST ENABLE 17 — 20 AWG
ARINC PGM 9 ④
SELF-TEST ⑤ 16 — 26 AWG — 25
+22 V DC REF 20 — 26 AWG — 49
INST FLAG (-) ⑨ 18 — 26 AWG
P
⑥
FLIGHT DIRECTOR OR OTHER SYSTEM
+DC ANALOG ALT ⑦ 23 — 57
-DC ANALOG ALT ⑦ 22 — 59
FLIGHT CONTROL SYSTEM AND GPWS
DH PROG ⑩ 12
EXTERNAL DH 2 — 26 AWG — EXTERNAL DH ANN PWR
EXTERNAL DH ⑨ 3 — 26 AWG — EXTERNAL DH ANN
DIM POTENTIOMETER HIGH (+5 V DC) 8
LOW 7
WIPER 24
⑧

NOTES:

① CONNECT PIN 5 OF DRI-55 CPN 622-4160-001-003,-005,-007,-011,-013,-015,-017, TO THE 5 V AIRCRAFT LIGHTING BUS. CONNECT PIN 4 OF DRI-55 CPN 622-4160-002,-004,-006,-008,-012,-014,-016,-018 TO THE 28 V AIRCRAFT LIGHTING BUS.

② DRI-55 UNITS WITHOUT SB 2 MUST HAVE P1-25 CONNECTED TO P1-15 FOR PROPER OPERATION OF THE DH ANNUNCIATOR, AND THE DH ANNUNCIATOR CANNOT BE DIMMED. DRI-55 UNITS WITH SB 2 AND ALL 622-4160-01X UNITS MAY HAVE P1-25 CONNECTED TO P1-15, OR THE DH ANNUNCIATOR MAY BE DIMMED BY THE ADDITION OF THE CIRCUIT BELOW.


DRI-55
P1
+28 V DC IND PWR (+) 25
DH LAMP 15
CW
BRIGHT

POTENTIOMETER IS 500 OHM, SINGLE TURN, WIREWOUND, 2 WATT. POT SHOULD BE INSTALLED IN THE COCKPIT WITHIN REACH OF THE PILOT/COPILOT.

③ ON INSTALLATIONS USING ONE DRI-55 INDICATOR THE RESISTANCE OF THE CONNECTING WIRE MUST BE LESS THAN 2.0 OHMS, OR LESS THAN 10 OHM FOR DUAL INDICATORS. THE FOLLOWING IS A LIST OF WIRE RESISTANCES:

NO. 25 AWG COPPER-25 FT PER OHM
NO. 24 AWG COPPER-40 FT PER OHM
NO. 22 AWG COPPER-62 FT PER OHM
NO. 20 AWG COPPER-100 FT PER OHM

④ SEE TABLE 1:

SYSTEM	P1 9	P1 10
ALT-50	NC	NC
ALT-55	NC	GND
ARINC	GND	NC

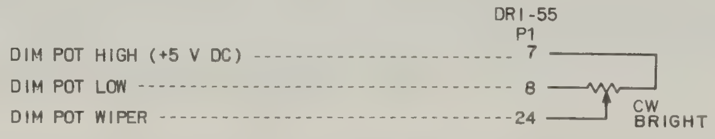
NC = NO CONNECTION
GND = GROUND (PIN 19 DC PWR GND)

⑤ INTERLOCK WITH FCS CAN BE USED TO OPEN THE SELF-TEST WIRE WHEN FCS IS ARMED.

⑥ GROUND SHIELD TO AIRFRAME AT ONE END ONLY.

⑦ DC ANALOG ALTITUDE WIRE AND MAXIMUM WIRE LENGTHS:
DRI-55 = NO. 22 AWG 65 FT MAXIMUM (1.0 OHM MAX)
DRI-55 = NO. 22 AWG FOR RUNS UP TO A MAXIMUM OF 30 FEET OR NO. 20 AWG FOR RUNS UP TO A MAXIMUM OF 50 FEET (0.5 OHM MAX).

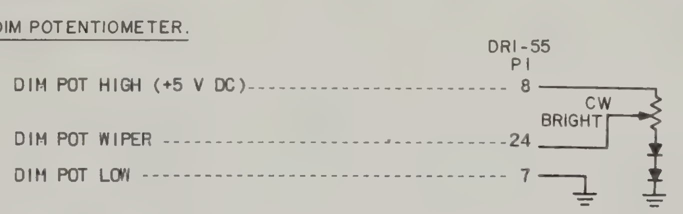
⑧ FOR DRI-55 UNITS CPN 622-4160-001,-002,-003,-004,-005,-006,-007,-008, A COMMON AIRCRAFT DIM CONTROL CANNOT BE USED BECAUSE +5 V DC AT P1-24 RESULTS IN MIN BRIGHTNESS AND 0 V DC AT P1-24 RESULTS IN MAX BRIGHTNESS. IF DIMMING IS DESIRED, A DEDICATED DIM POTENTIOMETER MAY BE CONNECTED AS SHOWN BELOW.


DRI-55
P1
DIM POT HIGH (+5 V DC) 7
DIM POT LOW 8
DIM POT WIPER 24
CW
BRIGHT

THE POT IS 5 kΩ, SINGLE TURN, 1/4 WATT, LINEAR TAPER. POT SHOULD BE INSTALLED IN THE COCKPIT WITHIN REACH OF THE PILOT/COPILOT.

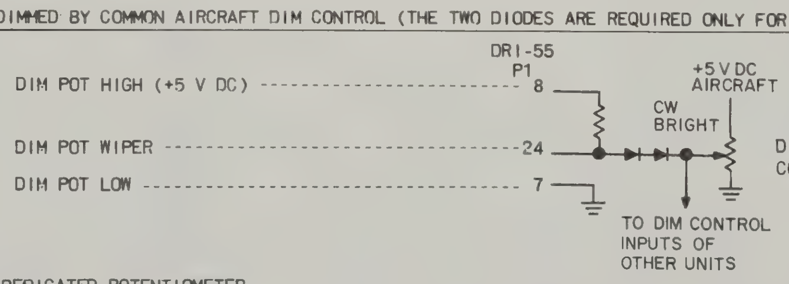
FOR DRI-55 UNITS CPN 622-4160-011,-012,-013,-014,-015,-016,-017,-018, A COMMON AIRCRAFT DIM CONTROL CAN BE USED BECAUSE +5 V DC AT P1-24 RESULTS IN MAX BRIGHTNESS AND +1.5 V DC AT P1-24 RESULTS IN MIN BRIGHTNESS. IF DIMMING IS DESIRED, THE DIM POTENTIOMETER MAY BE CONNECTED AS SHOWN BELOW. SEE PRO LINE EQUIPMENT SIL 1-80 FOR ADDITIONAL INFORMATION.

SINGLE DRI-55 DIMMED BY DEDICATED DIM POTENTIOMETER.


DRI-55
P1
DIM POT HIGH (+5 V DC) 8
DIM POT WIPER 24
DIM POT LOW 7
CW
BRIGHT

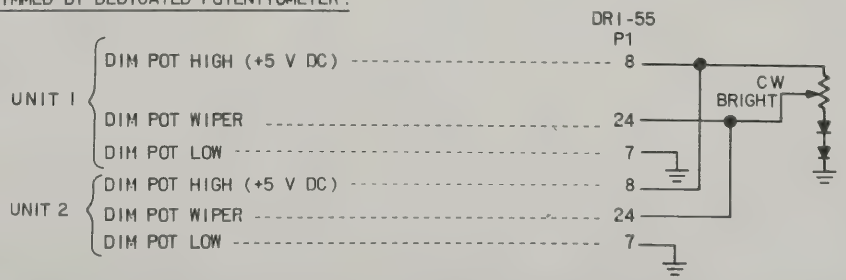
DIODES ARE IN4454, POT IS 1 kΩ, SINGLE TURN, 1/4 WATT, LINEAR TAPER. POT SHOULD BE INSTALLED IN THE COCKPIT WITHIN REACH OF THE PILOT/COPILOT.

SINGLE DRI-55 WITH DIFFERENT UNITS DIMMED BY COMMON AIRCRAFT DIM CONTROL (THE TWO DIODES ARE REQUIRED ONLY FOR THE DRI-55)


DRI-55
P1
+5 V DC AIRCRAFT
DIM POT HIGH (+5 V DC) 8
DIM POT WIPER 24
DIM POT LOW 7
CW
BRIGHT
TO DIM CONTROL INPUTS OF OTHER UNITS

DIODES ARE IN4454, RESISTOR IS 1 kΩ, 1/4 WATT COMPOSITION.

TWO OR MORE DRI-55 UNITS DIMMED BY DEDICATED POTENTIOMETER.


DRI-55
P1
UNIT 1
DIM POT HIGH (+5 V DC) 8
DIM POT WIPER 24
DIM POT LOW 7
UNIT 2
DIM POT HIGH (+5 V DC) 8
DIM POT WIPER 24
DIM POT LOW 7
CW
BRIGHT

DIODES ARE IN4454, POT IS 500 Ω, SINGLE TURN, 1/4 WATT, LINEAR TAPER. POT SHOULD BE INSTALLED IN THE COCKPIT WITHIN REACH OF THE PILOT/COPILOT.

⑨ A SECOND INDICATOR CAN BE OPERATED FROM A SINGLE ALT-50A/55B RADIO ALTIMETER. CONNECT SECOND INDICATOR IN PARALLEL WITH FIRST INDICATOR EXCEPT AS NOTED BELOW. OBSERVE DC ANALOG ALTITUDE SIGNAL WIRE RUNS AS SPECIFIED.

(a) USE ONE INDICATOR OR THE OTHER TO DRIVE A SINGLE EXTERNAL DH ANNUNCIATOR. DO NOT USE BOTH INDICATORS TO DRIVE 1 DH ANN.

(b) USE ONE INDICATOR OR THE OTHER TO DRIVE INST FLAG IN A SINGLE FLIGHT DIRECTOR SYSTEM, OR OTHER SINGLE SYSTEM.

⑩ FOR DRI-55 UNITS WITH SB-6 GROUNDING P1-12 TO P1-19 WILL KEEP THE DH INDICATOR FUNCTIONAL WHEN THE ALTITUDE READOUT IS 00 FT. WITH NO CONNECTION ON P1-12 THE DH FUNCTION WILL BE DISABLED WHEN THE DISPLAY READOUT IS 00 FT. FOR DRI-55 UNITS WITHOUT SB-6, P1-12 SHOULD BE OPEN.

⑪ ALL REAR CONNECTOR STRAPS SHOULD BE KEPT AS SHORT AS POSSIBLE; PREFERABLY UNDER 75.0 mm [3.0 in].

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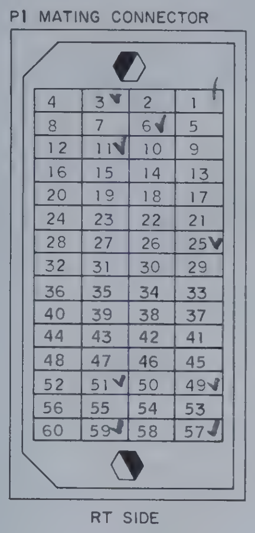
DRI-55 Digital Radio Altitude Indicator, Interconnect Wiring Diagram
Figure 2-2



1	+28 VDC PWR (+)	21	NO PIN	41	ALT TRIP NO. 1
2	NO PIN	22	AID 20 FT	42	NO PIN
3	+28 VDC GND (-)	23	NO PIN	43	ALT TRIP NO. 2
4	NO PIN	24	AID 40 FT	44	NO PIN
5	NO PIN	25	SELF-TEST	45	NO PIN
6	+28 VDC IND PWR (+)	26	NO PIN	46	ALT TRIP NO. 3
7	NO PIN	27	AID 57 FT	47	NO PIN
8	FCS WARN	28	NO PIN	48	ALT TRIP NO. 4
9	SPARE	29	NO PIN	49	+22 VDC REF
10	NO PIN	30	MOD PHASE COMMON	50	NO PIN
11	DC PWR GND	31	NO PIN	51	-15 VDC REF
12	NO PIN	32	MOD PHASE 0°	52	NO PIN
13	NO PIN	33	MOD PHASE 180°	53	NO PIN
14	DC CHASSIS GND	34	NO PIN	54	SPARE
15	NO PIN	35	MOD FREQ COMMON	55	NO PIN
16	MODULATION OSC	36	NO PIN	56	SPARE
17	MODULATION OSC	37	NO PIN	57	+DC ANALOG ALT
18	NO PIN	38	MOD FREQ 100 HZ	58	NO PIN
19	AID COMMON	39	NO PIN	59	-DC ANALOG ALT
20	NO PIN	40	MOD FREQ 105 HZ	60	NO PIN

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TP3-1554-024

ALT-50 Radio Altimeter System for 2,000-Foot Operation,
Interconnect Wiring Diagram
Figure 2-1 (Sheet 2)

2. Removal

Using extraction tool (CPN 372-8091-010), insert tool in front of connector to unlock contact and pull contact out rear of connector.

2.3.2 Antenna Cables

2.3.2.1 Aircraft Installation Delay (AID) Requirement

The radio altimeter system must be adjusted to read 0-foot altitude at the point of touchdown. Therefore, compensation for the antenna cable lengths and the antenna height above the ground at the point of touchdown must be made by applying AID bias. The AID bias is available in the ALT-50A by jumpering rear connector pins. Jumpering is physically accomplished by jumpering connector pins on the rear of the shockmount connector.

In determining the correct height of the antenna, do not measure the antenna height of a parked aircraft. The landing gear of a parked aircraft is loaded, and the antenna height is not the same as at the point of touchdown. A simulated touchdown position can be obtained by jacking up the aircraft until the landing gear is unloaded; however, the aircraft pitch attitude at touchdown must also be taken into consideration.

The ALT-50A provides AID bias adjustments of 20, 40, and 57 feet. Selection of 20-foot AID is made by jumpering connector pin P1-22 to P1-19. Selection of 40-foot AID is made by jumpering P1-24 to P1-19, and selection of 57-foot AID is made by jumpering P1-27 to P1-19.

After the antenna height is determined, refer to figure 2-3 to determine AID and cable length. The antenna height shown on figure 2-3 is one-half the distance of a path from the transmit antenna to ground and back to the receive antenna.

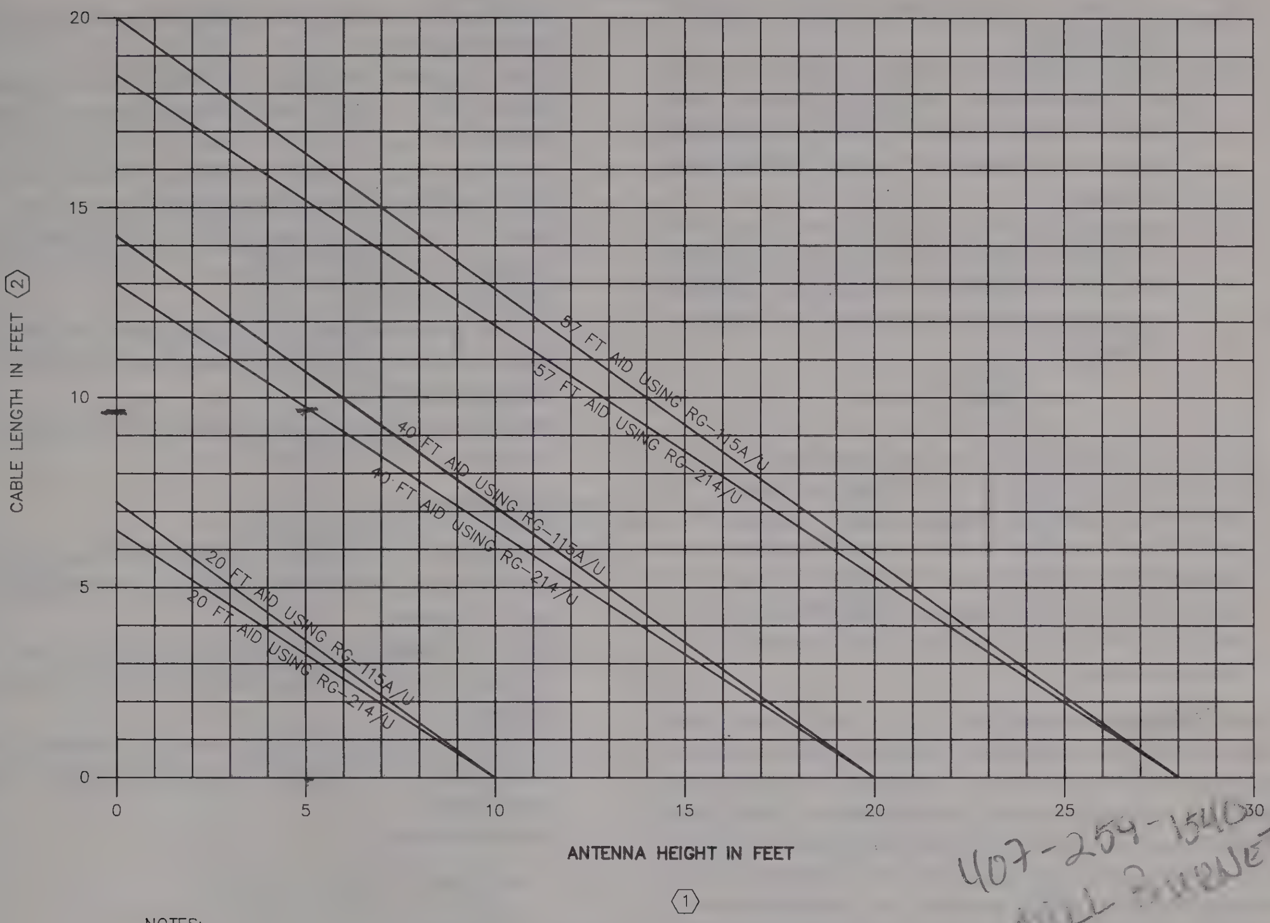
2.3.2.2 Antenna Cable Length

The required antenna cable lengths shown in figure 2-3 depend on the AID used and antenna height. Figure 2-3 provides cable lengths for cables fabricated with RG-214/U that has a propagation factor of 0.66 and for RG-115A/U that has a propagation factor of 0.695. Cable lengths are critical and must be measured accurately. The AID and cable requirement graph was produced using the following formula:

$$AID_{feet} = P + K\,(C_t + C_r)$$

Where:

AID = aircraft installation delay in feet.
P = total minimum path length in feet from transmitting antenna to ground and back to receiving antenna when the aircraft is in the touchdown configuration.



407-259-1540
BILL BURNETT

NOTES:

① ANTENNA HEIGHT SHOWN IS ONE-HALF THE DISTANCE OF THE SIGNAL PATH FROM THE TRANSMIT ANTENNA TO GROUND AND BACK TO RECEIVE ANTENNA WITH THE AIRCRAFT IN TOUCHDOWN CONFIGURATION.

② CABLE LENGTH SHOWN IS FOR EACH CABLE WHEN TRANSMIT AND RECEIVE CABLES OF EQUAL LENGTH ARE USED.

CG0-0076-01-AC-0

Aircraft Installation Delay (AID) and RF Cable Requirements Chart
Figure 2-3

Below is a list of parameters for coaxial cable also approved for use with the ALT-50A installations.

COAXIAL CABLE	VELOCITY FACTOR	DIELECTRIC OUTSIDE DIAMETER (in)	OUTSIDE DIAMETER (in)	TEMP RANGE (C)	LOSS/FT AT 5 GHz (dB)	CHAR IMP	MATING CONNECTOR
RG-393/U (425-1684-010)	0.694	0.285	0.390	-55 +200	0.210	50	*296-T1800Y
RG-325/U	0.870	0.260	0.350	-55 +80	0.141	50	*258-T1800B

*No Collins part number, Vendor type number listed for Automatic Connector, Inc., 400 Moreland Road, Commack, NY 11725

K = reciprocal of the coaxial cable speed of propagation.

C_t = transmitter cable length in feet from the ALT-50A to the 437X-1/1A/1B or ANT-50A/51A/52 (transmit). Does not include any cable or delay within the ALT-50A or antenna.

C_r = receiver cable length in feet from the ALT-50A to the 437X-1/1A/1B or ANT-50A/51A/52 (receive). Does not include any cable or delay within the ALT-50A or antenna.

Note

RG-214/U Cable, Collins part number 425-1532-000, or RG-115A/U, Collins part number 425-1571-000, is recommended. Use of cable that does not conform to MIL standards of RG-214/U or RG-115A/U will affect the ALT-50 system performance, resulting in erratic readings and intermittent operation.

Figure 2-3 assumes the length of a single cable and assumes that both the transmit and receive antenna cables are of equal length. However, if installation problems require unequal length cables, the cable length shown on figure 2-3 must be doubled and the sum of the unequal transmit and receive cable lengths must equal this amount. Any excessive cable should be coiled up and secured to the aircraft. The transmit and receive cables must be continuous without any intervening connectors or breaks.

2.4 INSTALLATION AND REMOVAL PROCEDURES

2.4.1 390R-19 Mounting Tray/UMT-12 Mount

2.4.1.1 Location

The 390R-19 or UMT-12 is mounted in the location determined for the ALT-50A. Refer to figure 2-7 for outline and mounting dimensions of the 390R-19. Refer to the 390R-18/19/20 Universal Mounting Kit Assembly Instructions (CPN 523-0764521) for additional information. Refer to figures 2-4 through 2-6 for outline and mounting dimensions of the UMT-12. Refer to the UMT-( ) Mounts and Thin Line II Connectors Instruction Book (CPN 523-0772277) for additional information.

2.4.1.2 Installation

Note

Perform steps a through c only on initial installation of the mount.

a. Remove two screws and connector cover plate on rear of mount.
b. Slide grommet that holds wiring harness out of mount and install on wiring harness. These grommets are available as part of optional connector housing kit (390R-19, CPN 621-8533-002; UMT-12, CPN 621-8533-002), if required.
c. Install thin-line connector (CPN 634-1112-001) on wiring harness and in mount. Secure to mount with four screws.
d. Install grommet with wiring harness in mount.
e. Install connector cover plate on mount and secure with two screws.
f. Install mount in airframe and secure with four screws.

2.4.1.3 Removal

a. Remove four screws and mount from airframe.
b. Remove two screws and connector cover plate on rear of mount.
c. Carefully slide grommet with wiring harness out of mount to provide access to screws securing connector.
d. Remove four screws that secure connector to mount and remove connector and wiring harness from mount.
e. Remove mount.

2.4.2 ALT-50A Radio Altimeter

2.4.2.1 Location

The location of the ALT-50A is dependent upon the length of the antenna cables. Length of the antenna cables is defined in paragraph 2.3.2. Refer to figure 2-8 for outline and mounting dimensions.

2.4.2.2 Installation

a. Position ALT-50A in front of mount.
b. Carefully slide back ALT-50A on mount until rear connector is firmly engaged with mount connector. Connector guide pins must be aligned to ensure correct mating of connectors.
c. Secure ALT-50A to mount by tightening two knurled knobs.
d. Safety-wire knurled knobs.
e. Connect receive and transmit antenna cables to the two TNC connectors on the front of ALT-50A.

2.4.2.3 Removal

a. Disconnect two TNC connectors on receive and transmit antenna cables at front of ALT-50A. Tag cable to ensure correct reinstallation.

Table 2-1. ALT-50A Mating Connectors.

AIRCRAFT TYPE	DESCRIPTION	COLLINS PART NUMBER	QTY
PREFERRED			
Fixed-wing	UMT-12 Mount Connector kit (includes 30 contacts (CPN 372-2514-110), and TNC connectors).	622-5212-001 634-4192-006	1 1
Fixed-wing	UMT-12 Mount Connector kit	622-5212-001 634-1021-001	1 1
	Crimp contacts Up to 0.050 in dia or	372-2514-110	*30
	0.050 to 0.080 insulation dia	372-2514-180	*30
	TNC connectors (for RG-214/U coax)	357-7204-010	2
Helicopter	UMT-12 Mount Connector kit	622-5212-003 634-1898-003	1 1
	Crimp contacts Up to 0.050 in dia or	372-2514-110	*30
	0.050 to 0.080 insulation dia	372-2514-180	*30
	TNC connectors (for RG-214/U coax)	357-7204-010	2
**ALTERNATE			
Fixed-wing	390R-19 Mounting Tray Connector kit (includes 30 contacts (CPN 372-2514-110), and TNC connectors).	622-1195-301 634-4193-008	1 1
Fixed-wing	390R-19 Mounting Tray Connector kit	622-1195-301 634-1898-001	1 1
	Crimp contacts Up to 0.050 in dia or	372-2514-110	*30
	0.050 to 0.080 insulation dia	372-2514-180	*30
	TNC connectors (for RG-214/U coax)	357-7204-010	2
Helicopter	390R-19 Mounting Tray Connector kit	622-1195-301 634-1898-003	1 1
	Crimp contacts Up to 0.050 in dia or	372-2514-110	*30
	0.050 to 0.080 insulation dia	372-2514-180	*30
	TNC connectors (for RG-214/U coax)	357-7204-010	2

*Quantity required for typical installation
**Recommended installation only where UMT-series mount cannot be used.

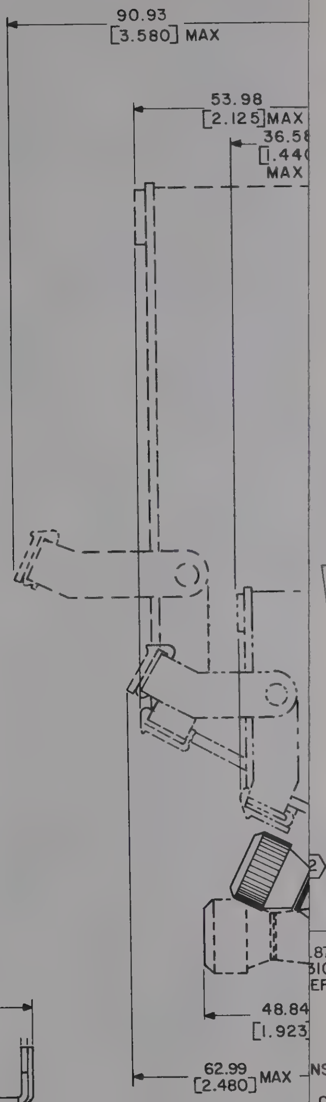
Table 2-2. Connector Kit Components.

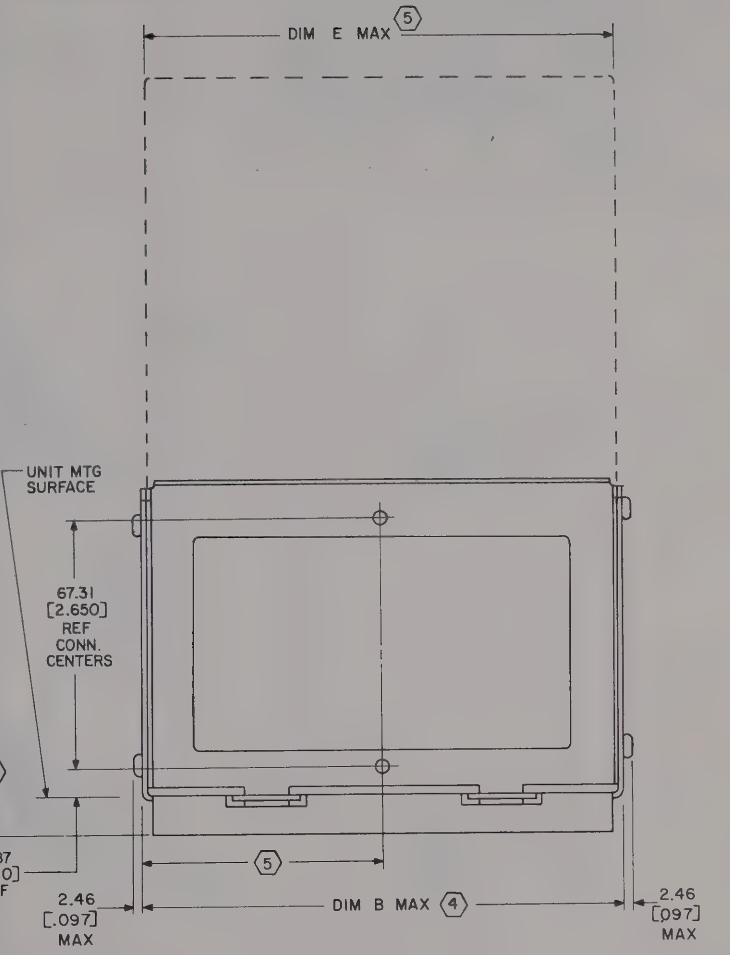
CONNECTOR KIT PART NUMBER	COMPONENT DESCRIPTION	COLLINS PART NUMBER	QTY
634-1021-001	Thinline II connector	634-1112-001	1
	Captive ring, keyway	634-1117-001	3
	Keyway	634-1116-001	2
	Insert, fastener	334-2117-010	2
	Screw, 4-40 x 0.38	324-2604-000	2
634-1898-001	Thinline II connector	634-1112-001	1
	Connector plate assembly	634-1130-003	1
	Captive ring, keyway	634-1117-001	3
	Keyway	634-1116-001	2
	Flat washer, no 4	310-0779-030	2
	Screw, cap, 0.112-40 x 0.500	324-2605-000	2
634-1898-003	Thinline II connector	634-1112-001	1
	Connector plate assembly	634-3387-005	1
	Captive ring, keyway	634-1117-001	3
	Keyway	634-1116-001	2
	Screw, cap, 0.112-40 x 0.500	324-2605-000	2
634-4192-006	Thinline II connector	634-1112-001	1
	Coax connector (for RG-214/U coax)	357-7204-010	2
	Contact	372-2514-110	30
	Captive ring, keyway	634-1117-001	3
	Keyway	634-1116-001	2
	Insert, fastener	334-2117-010	2
	Screw, 4-40 x 0.38	324-2604-000	2
634-4193-008	Thinline II connector	634-1112-001	1
	Coax connector (for RG-214/U coax)	357-7204-010	2
	Contact	372-2514-110	30
	Captive ring, keyway	634-1117-001	2
	Keyway	634-1116-001	2
	Screw, 4-40 x 0.50	324-2605-000	2
	Flat washer, no 4	310-0779-030	2

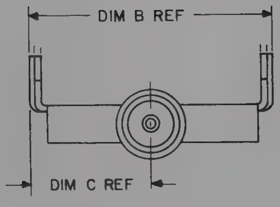
Table 2-3. Mating Connector Contacts and Special Tools.

MATING CONNECTOR CONTACTS		ASSOCIATED SPECIAL TOOLS		
DESCRIPTION	COLLINS PART NUMBER	CRIMPING	INSERTION	EXTRACTION
Snap-in tuning fork (wire with insulation up to 0.050-in dia)	372-2514-110	623-8579-001 or 359-0697-010 *(Daniels GMT-221)	359-0697-050 *(Daniels DAK-188)	359-0697-020 *(Daniels DRK-230)
Snap-in tuning fork (wire with insulation 0.050- to 0.080-in dia)	372-2514-180	359-0697-010 *(Daniels GMT-221)	359-0697-050 *(Daniels DAK-188)	359-0697-020 *(Daniels DRK-230)
Coax insert	372-2519-040	357-8622-010 with 357-8622-160		370-8040-030

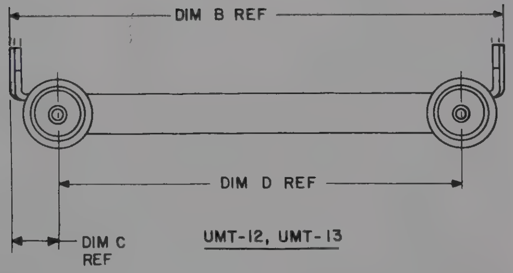
*Special tools are available in connector kit 359-0697-080 (Daniels DME-593) or can be ordered from: Daniels Manufacturing Corp., 2266 Franklin Road, Bloomfield Hills, Michigan 48013.


90.93
[3.580] MAX
53.98
[2.125]MAX
36.58
[1.44
MAX
2
.87
310]
EF
48.84
[1.923
62.99
[2.480] MAX


DIM E MAX ⑤
UNIT MTG
SURFACE
67.31
[2.650]
REF
CONN.
CENTERS
⑤
2.46
[.097]
MAX
DIM B MAX ④
2.46
[.097]
MAX


DIM B REF
DIM C REF

UMT-10, UMT-11


DIM B REF
DIM D REF
DIM C
REF

UMT-12, UMT-13

NS ARE IN MILLIMETRES [INCHES].

CONNECTOR COVER KITS ARE 621-8533-001 THROUGH -004.

MBER -002 MOUNTS ARE FOR FULL HEIGHT ATR UNITS AND INCLUDE CORNER
BRACKETS, 634-1125-001 AND -002.

[.108] TO DIMENSION B AT REAR FOR DASH No.-002 MOUNTS.

INDIVIDUAL EQUIPMENT INSTALLATION CONTROL DWGS FOR DETAIL DIMENSIONS.

VE BEEN DESIGNED AND TESTED FOR MOUNTING ON A HORIZONTAL SURFACE. A CHANGE IN
ATTITUDE WILL REQUIRE TESTING AND APPROVAL BY GENERAL AVIATION ENGINEERING.

DOES NOT INCLUDE CONNECTOR COVER.

ENT	COLLINS PART NO.	DIM A	DIM B	DIM C	DIM D	DIM E	WEIGHT kg [LBS]
10	622-5210-001,-002, -003	28.58 [1.125]	46.7 [1.84]	23.4 [.92]	N/A	41.9 [1.65]	0.14 [.31]
11	622-5211-001,-002, -003	44.45 [1.750]	63.2 [2.49]	31.8 [1.25]	N/A	58.4 [2.30]	0.16 [.34]
2	622-5212-001,-002, -003	77.77 [3.062]	96.5 [3.80]	12.7 [.50]	71.45 [2.813]	91.7 [3.61]	0.20 [.44]
3	622-5213-001,-002, -003	111.12 [4.375]	130.0 [5.12]	12.7 [.50]	104.78 [4.125]	125.0 [4.92]	0.23 [.52]
	③		④			⑤	⑦

647-3665
TP6-1563-014

UMT-10/11/12/13 Mount, Outline and Mounting Dimensions
Figure 2-4

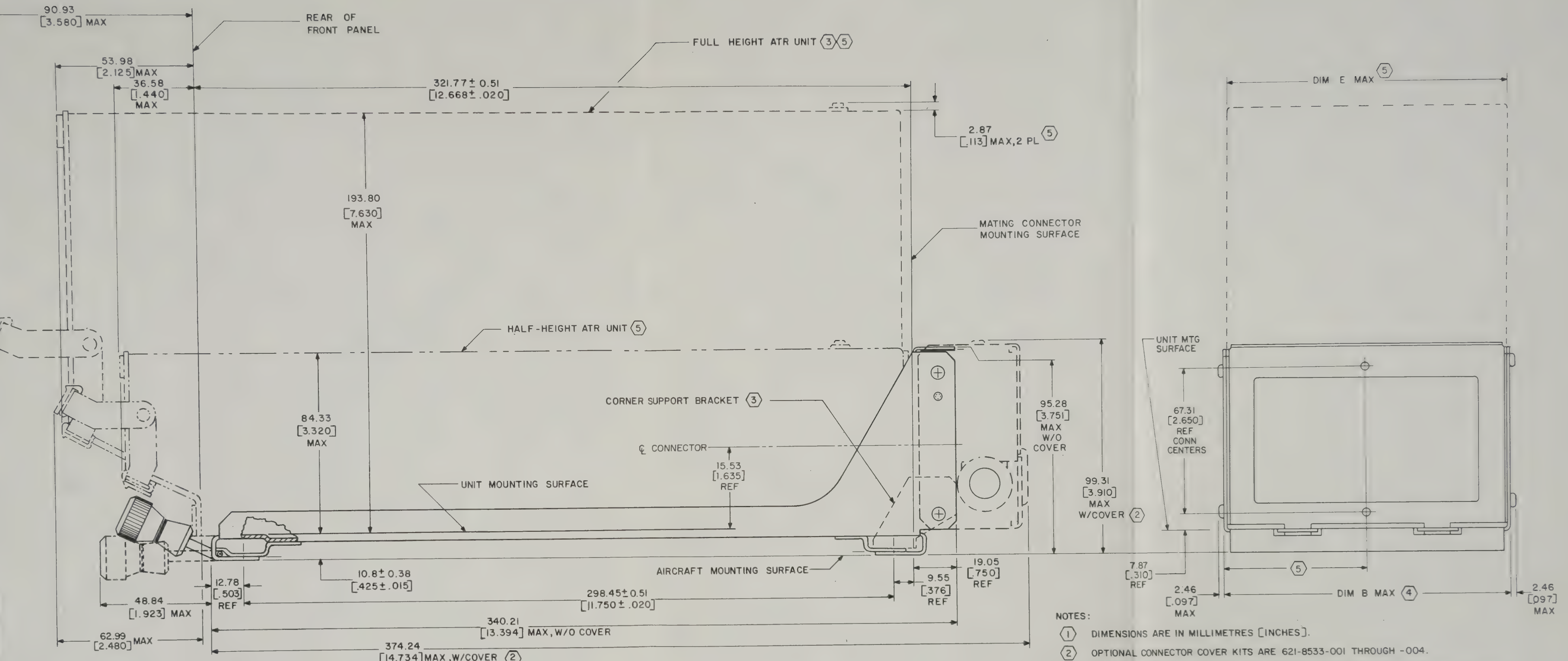
Table 2-2. Connector Kit Components.

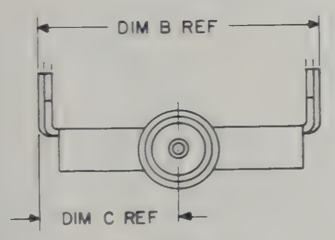
CONNECTOR KIT PART NUMBER	COMPONENT DESCRIPTION	COLLINS PART NUMBER	QTY
634-1021-001	Thinline II connector	634-1112-001	1
	Captive ring, keyway	634-1117-001	3
	Keyway	634-1116-001	2
	Insert, fastener	334-2117-010	2
	Screw, 4-40 x 0.38	324-2604-000	2
634-1898-001	Thinline II connector	634-1112-001	1
	Connector plate assembly	634-1130-003	1
	Captive ring, keyway	634-1117-001	3
	Keyway	634-1116-001	2
	Flat washer, no 4	310-0779-030	2
	Screw, cap, 0.112-40 x 0.500	324-2605-000	2
634-1898-003	Thinline II connector	634-1112-001	1
	Connector plate assembly	634-3387-005	1
	Captive ring, keyway	634-1117-001	3
	Keyway	634-1116-001	2
	Screw, cap, 0.112-40 x 0.500	324-2605-000	2
634-4192-006	Thinline II connector	634-1112-001	1
	Coax connector (for RG-214/U coax)	357-7204-010	2
	Contact	372-2514-110	30
	Captive ring, keyway	634-1117-001	3
	Keyway	634-1116-001	2
	Insert, fastener	334-2117-010	2
	Screw, 4-40 x 0.38	324-2604-000	2
634-4193-008	Thinline II connector	634-1112-001	1
	Coax connector (for RG-214/U coax)	357-7204-010	2
	Contact	372-2514-110	30
	Captive ring, keyway	634-1117-001	2
	Keyway	634-1116-001	2
	Screw, 4-40 x 0.50	324-2605-000	2
	Flat washer, no 4	310-0779-030	2

Table 2-3. Mating Connector Contacts and Special Tools.

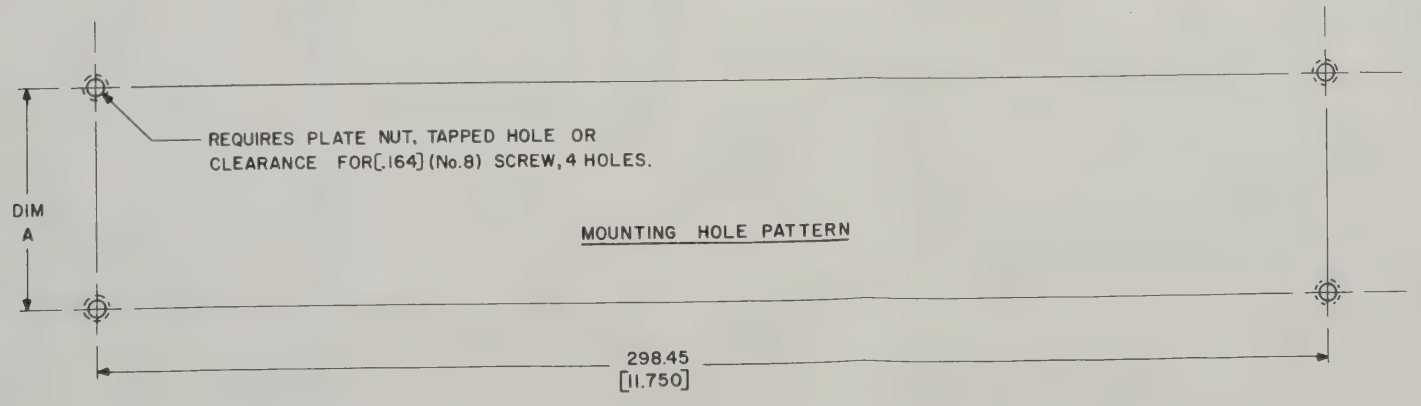
MATING CONNECTOR CONTACTS		ASSOCIATED SPECIAL TOOLS		
DESCRIPTION	COLLINS PART NUMBER	CRIMPING	INSERTION	EXTRACTION
Snap-in tuning fork (wire with insulation up to 0.050-in dia)	372-2514-110	623-8579-001 or 359-0697-010 *(Daniels GMT-221)	359-0697-050 *(Daniels DAK-188)	359-0697-020 *(Daniels DRK-230)
Snap-in tuning fork (wire with insulation 0.050- to 0.080-in dia)	372-2514-180	359-0697-010 *(Daniels GMT-221)	359-0697-050 *(Daniels DAK-188)	359-0697-020 *(Daniels DRK-230)
Coax insert	372-2519-040	357-8622-010 with 357-8622-160		370-8040-030

*Special tools are available in connector kit 359-0697-080 (Daniels DME-593) or can be ordered from: Daniels Manufacturing Corp., 2266 Franklin Road, Bloomfield Hills, Michigan 48013.

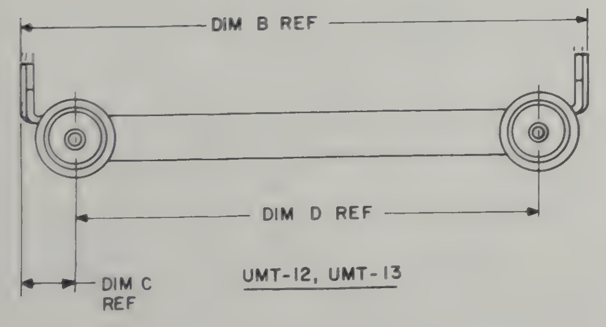

90.93
[3.580] MAX
REAR OF
FRONT PANEL
FULL HEIGHT ATR UNIT ③⑤
53.98
[2.125]MAX
36.58
[1.440]
MAX
321.77± 0.51
[12.668± .020]
2.87
[.113] MAX, 2 PL ⑤
193.80
[7.630]
MAX
MATING CONNECTOR
MOUNTING SURFACE
HALF-HEIGHT ATR UNIT ⑤
CORNER SUPPORT BRACKET ③
84.33
[3.320]
MAX
℄ CONNECTOR
15.53
[1.635]
REF
UNIT MOUNTING SURFACE
95.28
[3.751]
MAX
W/O
COVER
99.31
[3.910]
MAX
W/COVER ②
AIRCRAFT MOUNTING SURFACE
10.8± 0.38
[.425± .015]
12.78
[.503]
REF
48.84
[1.923] MAX
298.45± 0.51
[11.750 ± .020]
9.55
[.376]
REF
19.05
[.750]
REF
340.21
[13.394] MAX, W/O COVER
62.99
[2.480] MAX
374.24
[14.734]MAX ,W/COVER ②
DIM E MAX ⑤
UNIT MTG
SURFACE
67.31
[2.650]
REF
CONN
CENTERS
7.87
[.310]
REF
⑤
2.46
[.097]
MAX
DIM B MAX ④
2.46
[.097]
MAX


DIM B REF
DIM C REF

UMT-10, UMT-11


REQUIRES PLATE NUT, TAPPED HOLE OR
CLEARANCE FOR[.164](No.8) SCREW, 4 HOLES.
DIM
A
298.45
[11.750]

MOUNTING HOLE PATTERN


DIM B REF
DIM D REF
DIM C
REF

UMT-12, UMT-13

NOTES:

① DIMENSIONS ARE IN MILLIMETRES [INCHES].

② OPTIONAL CONNECTOR COVER KITS ARE 621-8533-001 THROUGH -004.

③ DASH NUMBER -002 MOUNTS ARE FOR FULL HEIGHT ATR UNITS AND INCLUDE CORNER SUPPORT BRACKETS, 634-1125-001 AND -002.

④ ADD 2.74 [.108] TO DIMENSION B AT REAR FOR DASH No. -002 MOUNTS.

⑤ REFER TO INDIVIDUAL EQUIPMENT INSTALLATION CONTROL DWGS FOR DETAIL DIMENSIONS.

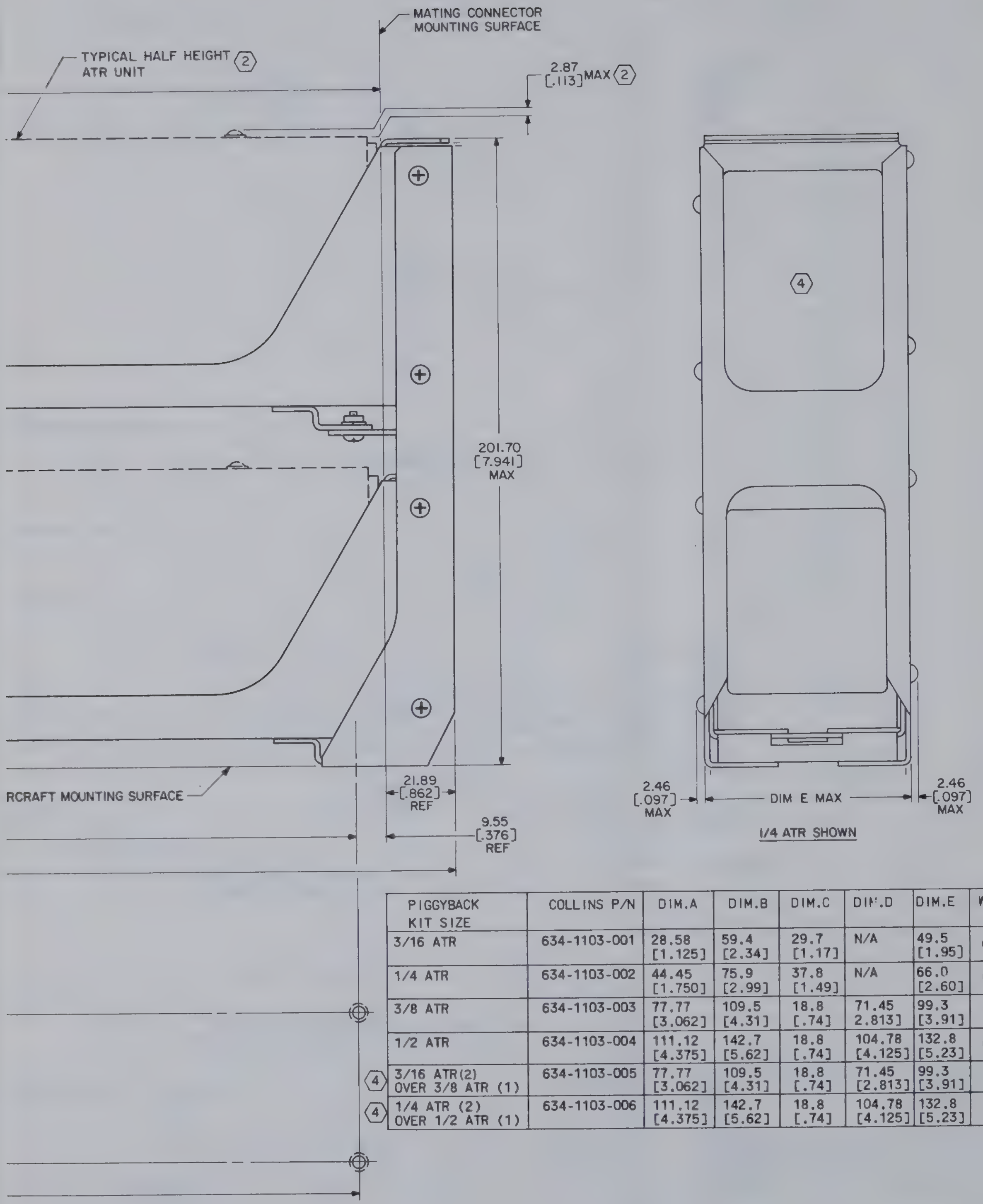
⑥ UNITS HAVE BEEN DESIGNED AND TESTED FOR MOUNTING ON A HORIZONTAL SURFACE. A CHANGE IN MOUNTING ATTITUDE WILL REQUIRE TESTING AND APPROVAL BY GENERAL AVIATION ENGINEERING.

⑦ WEIGHT DOES NOT INCLUDE CONNECTOR COVER.

ATR	EQUIPMENT	COLLINS PART NO.	DIM A	DIM B	DIM C	DIM D	DIM E	WEIGHT kg [LBS]
3/16	UMT-10	622-5210-001,-002, -003	28.58 [1.125]	46.7 [1.84]	23.4 [.92]	N/A	41.9 [1.65]	0.14 [.31]
1/4	UMT-11	622-5211-001,-002, -003	44.45 [1.750]	63.2 [2.49]	31.8 [1.25]	N/A	58.4 [2.30]	0.16 [.34]
3/8	UMT-12	622-5212-001,-002, -003	77.77 [3.062]	96.5 [3.80]	12.7 [.50]	71.45 [2.813]	91.7 [3.61]	0.20 [.44]
1/2	UMT-13	622-5213-001,-002, -003	111.12 [4.375]	130.0 [5.12]	12.7 [.50]	104.78 [4.125]	125.0 [4.92]	0.23 [.52]
		③		④			⑤	⑦

647-3665
TPS-1563-014

UMT-10/11/12/13 Mount, Outline and Mounting Dimensions
Figure 2-4


MATING CONNECTOR MOUNTING SURFACE
TYPICAL HALF HEIGHT ATR UNIT ⟨2⟩
2.87 [.113] MAX ⟨2⟩
⟨4⟩
201.70 [7.941] MAX
RCRAFT MOUNTING SURFACE
21.89 [.862] REF
9.55 [.376] REF
2.46 [.097] MAX
DIM E MAX
2.46 [.097] MAX
1/4 ATR SHOWN
⟨5⟩

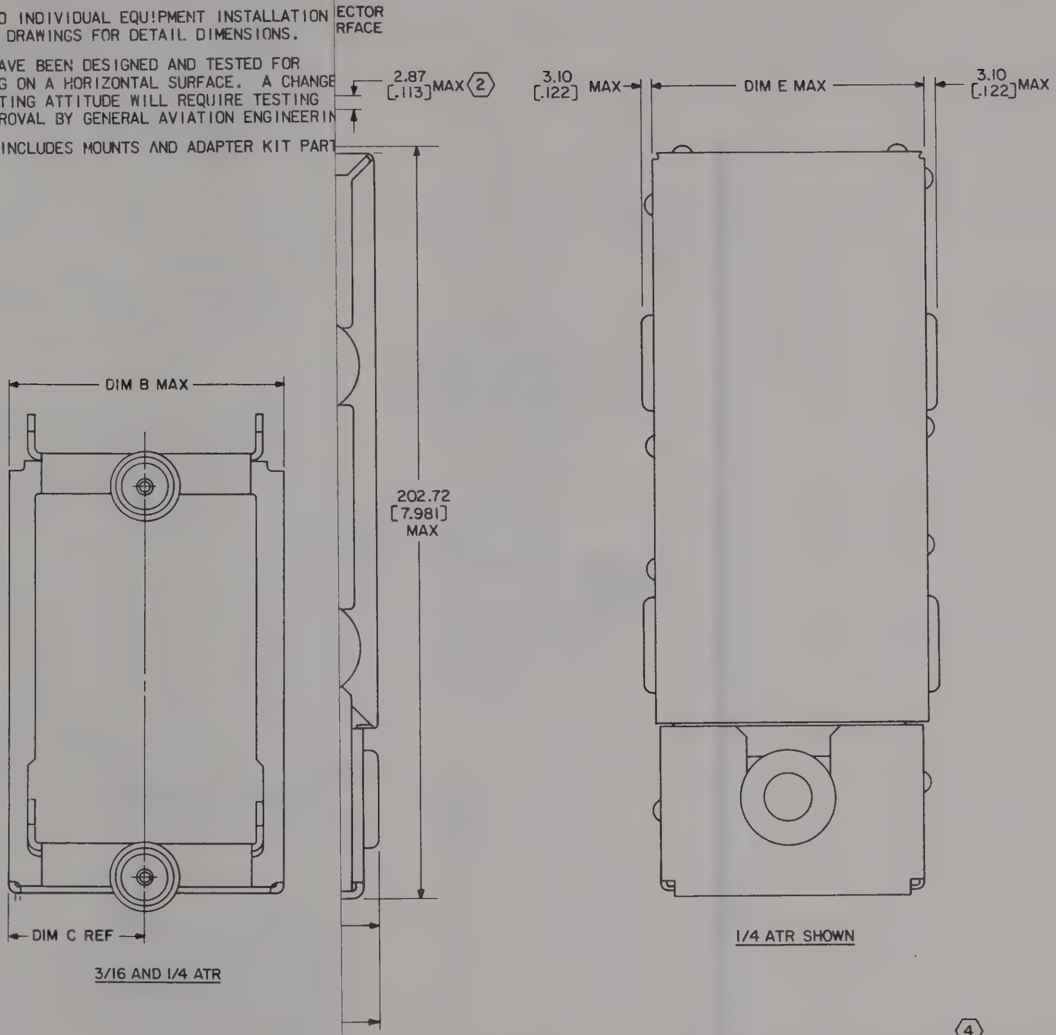
PIGGYBACK KIT SIZE	COLLINS P/N	DIM.A	DIM.B	DIM.C	DIM.D	DIM.E	WEIGHT,Kg [LBS]
3/16 ATR	634-1103-001	28.58 [1.125]	59.4 [2.34]	29.7 [1.17]	N/A	49.5 [1.95]	0.39 [.85]
1/4 ATR	634-1103-002	44.45 [1.750]	75.9 [2.99]	37.8 [1.49]	N/A	66.0 [2.60]	0.43 [.95]
3/8 ATR	634-1103-003	77.77 [3.062]	109.5 [4.31]	18.8 [.74]	71.45 2.813]	99.3 [3.91]	0.55 [1.21]
1/2 ATR	634-1103-004	111.12 [4.375]	142.7 [5.62]	18.8 [.74]	104.78 [4.125]	132.8 [5.23]	0.65 [1.43]
⟨4⟩ 3/16 ATR(2) OVER 3/8 ATR (1)	634-1103-005	77.77 [3.062]	109.5 [4.31]	18.8 [.74]	71.45 [2.813]	99.3 [3.91]	0.63 [1.40]
⟨4⟩ 1/4 ATR (2) OVER 1/2 ATR (1)	634-1103-006	111.12 [4.375]	142.7 [5.62]	18.8 [.74]	104.78 [4.125]	132.8 [5.23]	0.73 [1.61]

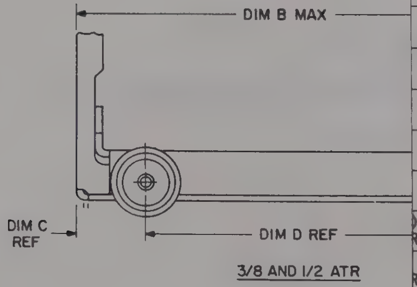
647-3723
TP6-1739-014

*UMT-10/11/12/13 Mount, Piggyback Mounting Without Cover,
Outline and Mounting Dimensions
Figure 2-5*

NOTES:

1. DIMENSIONS ARE IN MILLIMETRES [INCHES].
2. REFER TO INDIVIDUAL EQUIPMENT INSTALLATION CONTROL DRAWINGS FOR DETAIL DIMENSIONS.
3. UNITS HAVE BEEN DESIGNED AND TESTED FOR MOUNTING ON A HORIZONTAL SURFACE. A CHANGE IN MOUNTING ATTITUDE WILL REQUIRE TESTING AND APPROVAL BY GENERAL AVIATION ENGINEERIN
4. WEIGHT INCLUDES MOUNTS AND ADAPTER KIT PART


ECTOR
RFACE
2.87 [.113] MAX ⟨2⟩
3.10 [.122] MAX
DIM E MAX
3.10 [.122] MAX
DIM B MAX
202.72 [7.981] MAX
DIM C REF
3/16 AND 1/4 ATR
1/4 ATR SHOWN


DIM B MAX
DIM C REF
DIM D REF
3/8 AND 1/2 ATR

⟨4⟩

	COLLINS P/N	DIM.A	DIM.B	DIM.C	DIM.D	DIM.E	WEIGHT, kg[LBS]
	634-1104-001	28.58 [1.125]	59.4 [2.34]	29.7 [1.17]	N/A	51.6 [2.03]	0.46 [1.02]
	634-1104-002	44.45 [1.750]	75.9 [2.99]	37.8 [1.49]	N/A	68.1 [2.68]	0.5 [1.13]
	634-1104-003	77.77 [3.062]	109.5 [4.31]	18.8 [.74]	71.45 [2.813]	101.3 [3.99]	0.66 [1.44]
	634-1104-004	111.12 [4.375]	142.7 [5.62]	18.8 [.74]	104.78 [4.125]	134.6 [5.30]	0.76 [1.69]
) R (1)	634-1104-003	77.77 [3.062]	109.5 [4.31]	18.8 [.74]	71.45 [2.813]	101.3 [3.99]	0.73 [1.60]
R (1)	634-1104-004	111.12 [4.375]	142.7 [5.62]	18.8 [.74]	104.78 [4.125]	134.6 [5.30]	0.85 [1.88]

647-3730
TP6-1759-014

UMT-10/11/12/13 Mount, Piggyback Mounting With Cover, Outline and Mounting Dimensions
Figure 2-6

NOTES:

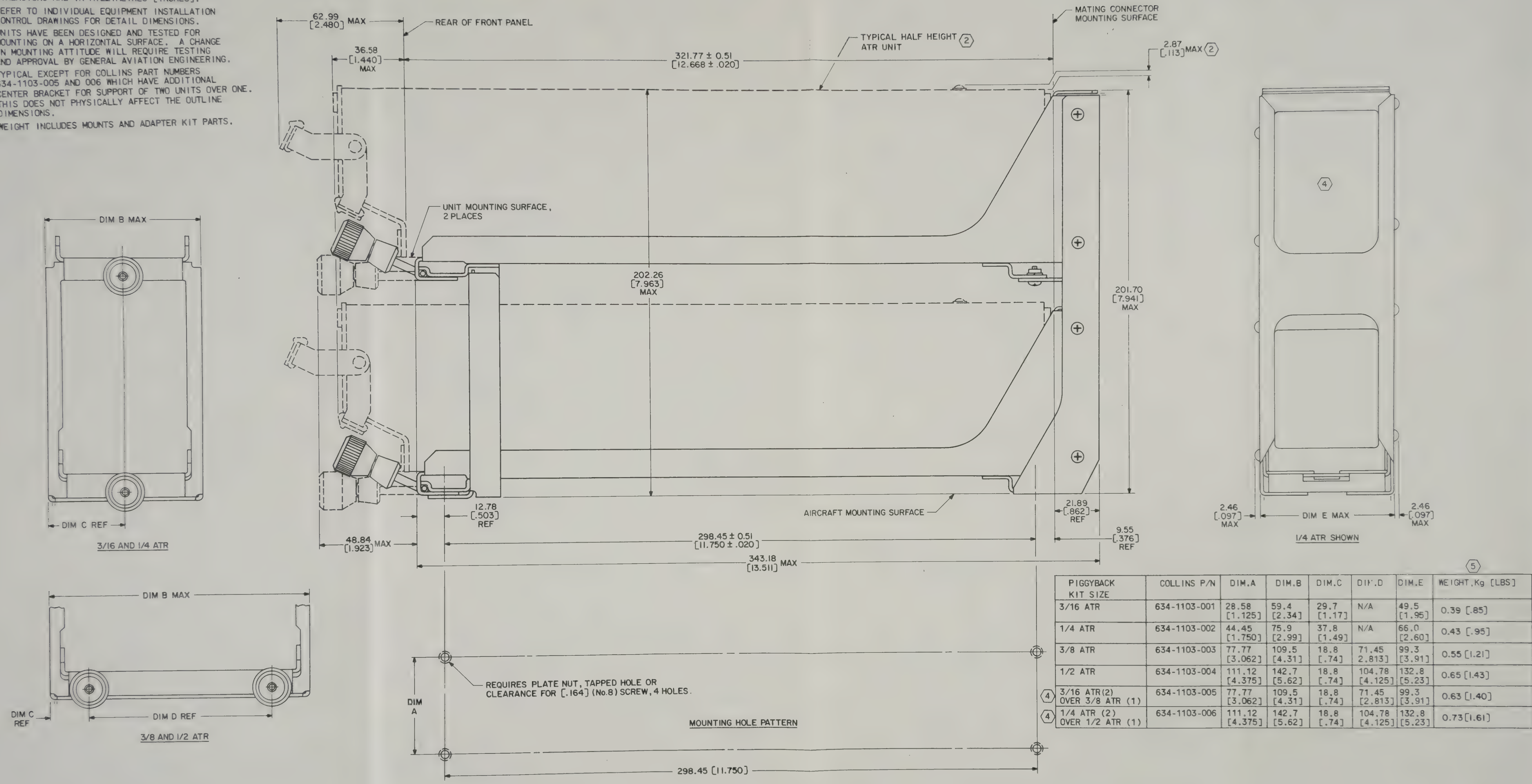
① DIMENSIONS ARE IN MILLIMETRES [INCHES].

② REFER TO INDIVIDUAL EQUIPMENT INSTALLATION CONTROL DRAWINGS FOR DETAIL DIMENSIONS.

③ UNITS HAVE BEEN DESIGNED AND TESTED FOR MOUNTING ON A HORIZONTAL SURFACE. A CHANGE IN MOUNTING ATTITUDE WILL REQUIRE TESTING AND APPROVAL BY GENERAL AVIATION ENGINEERING.

④ TYPICAL EXCEPT FOR COLLINS PART NUMBERS 634-1103-005 AND 006 WHICH HAVE ADDITIONAL CENTER BRACKET FOR SUPPORT OF TWO UNITS OVER ONE. THIS DOES NOT PHYSICALLY AFFECT THE OUTLINE DIMENSIONS.

⑤ WEIGHT INCLUDES MOUNTS AND ADAPTER KIT PARTS.


62.99 [2.480] MAX
REAR OF FRONT PANEL
36.58 [1.440] MAX
321.77 ± 0.51 [12.668 ± .020]
TYPICAL HALF HEIGHT ATR UNIT ②
MATING CONNECTOR MOUNTING SURFACE
2.87 [.113] MAX ②
UNIT MOUNTING SURFACE, 2 PLACES
202.26 [7.963] MAX
201.70 [7.941] MAX
AIRCRAFT MOUNTING SURFACE
12.78 [.503] REF
48.84 [1.923] MAX
298.45 ± 0.51 [11.750 ± .020]
21.89 [.862] REF
9.55 [.376] REF
343.18 [13.511] MAX
DIM B MAX
DIM C REF
3/16 AND 1/4 ATR
DIM B MAX
DIM C REF
DIM D REF
3/8 AND 1/2 ATR
④
2.46 [.097] MAX
DIM E MAX
2.46 [.097] MAX
1/4 ATR SHOWN
REQUIRES PLATE NUT, TAPPED HOLE OR CLEARANCE FOR [.164] (No.8) SCREW, 4 HOLES.
DIM A
MOUNTING HOLE PATTERN
298.45 [11.750]

PIGGYBACK KIT SIZE	COLLINS P/N	DIM.A	DIM.B	DIM.C	DIM.D	DIM.E	WEIGHT,Kg [LBS] ⑤
3/16 ATR	634-1103-001	28.58 [1.125]	59.4 [2.34]	29.7 [1.17]	N/A	49.5 [1.95]	0.39 [.85]
1/4 ATR	634-1103-002	44.45 [1.750]	75.9 [2.99]	37.8 [1.49]	N/A	66.0 [2.60]	0.43 [.95]
3/8 ATR	634-1103-003	77.77 [3.062]	109.5 [4.31]	18.8 [.74]	71.45 2.813]	99.3 [3.91]	0.55 [1.21]
1/2 ATR	634-1103-004	111.12 [4.375]	142.7 [5.62]	18.8 [.74]	104.78 [4.125]	132.8 [5.23]	0.65 [1.43]
④ 3/16 ATR(2) OVER 3/8 ATR (1)	634-1103-005	77.77 [3.062]	109.5 [4.31]	18.8 [.74]	71.45 [2.813]	99.3 [3.91]	0.63 [1.40]
④ 1/4 ATR (2) OVER 1/2 ATR (1)	634-1103-006	111.12 [4.375]	142.7 [5.62]	18.8 [.74]	104.78 [4.125]	132.8 [5.23]	0.73 [1.61]

647-3723
TP6-1739-014

UMT-10/11/12/13 Mount, Piggyback Mounting Without Cover,
Outline and Mounting Dimensions
Figure 2-5

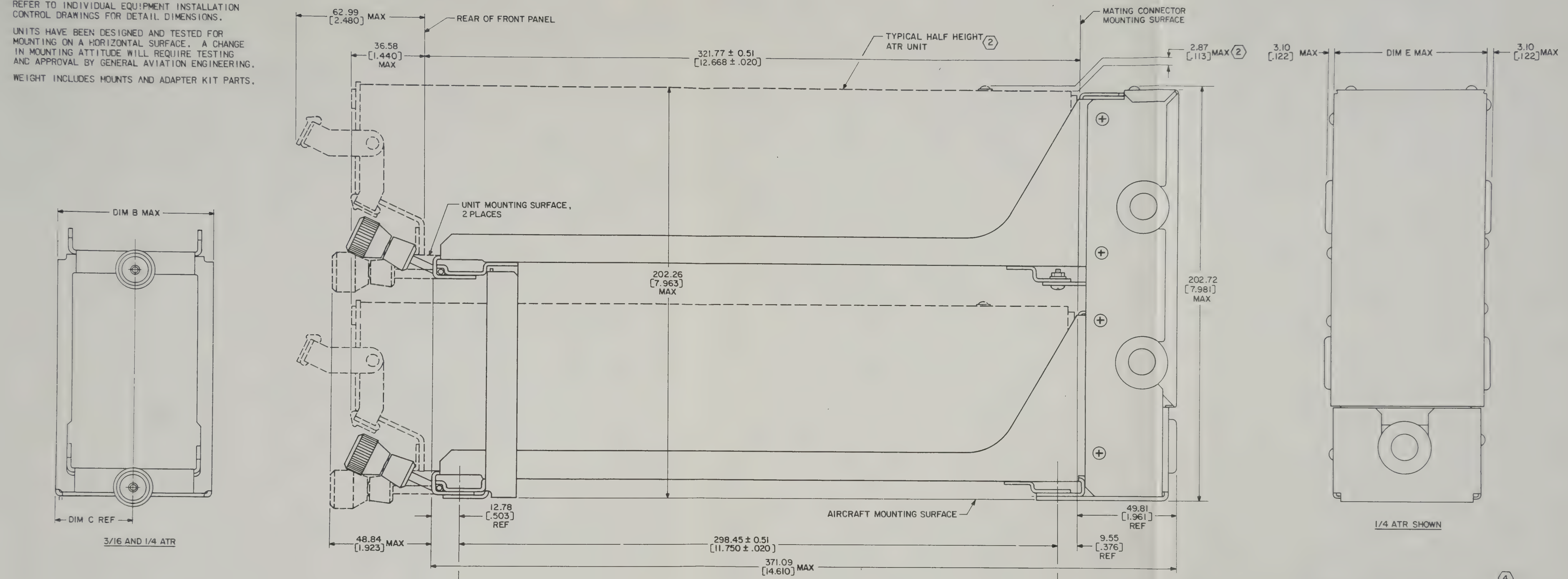
NOTES:

① DIMENSIONS ARE IN MILLIMETRES [INCHES].

② REFER TO INDIVIDUAL EQUIPMENT INSTALLATION CONTROL DRAWINGS FOR DETAIL DIMENSIONS.

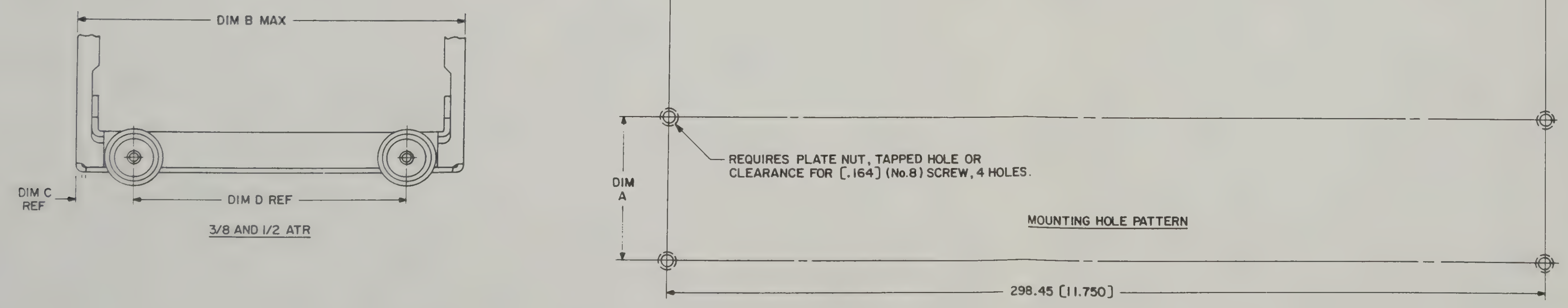
③ UNITS HAVE BEEN DESIGNED AND TESTED FOR MOUNTING ON A HORIZONTAL SURFACE. A CHANGE IN MOUNTING ATTITUDE WILL REQUIRE TESTING AND APPROVAL BY GENERAL AVIATION ENGINEERING.

④ WEIGHT INCLUDES MOUNTS AND ADAPTER KIT PARTS.


62.99 [2.480] MAX
REAR OF FRONT PANEL
36.58 [1.440] MAX
321.77 ± 0.51 [12.668 ± .020]
TYPICAL HALF HEIGHT ATR UNIT ②
MATING CONNECTOR MOUNTING SURFACE
2.87 [.113] MAX ②
3.10 [.122] MAX
DIM E MAX
3.10 [.122] MAX
UNIT MOUNTING SURFACE, 2 PLACES
202.26 [7.963] MAX
202.72 [7.981] MAX
DIM B MAX
DIM C REF
12.78 [.503] REF
AIRCRAFT MOUNTING SURFACE
49.81 [1.961] REF
48.84 [1.923] MAX
298.45 ± 0.51 [11.750 ± .020]
9.55 [.376] REF
371.09 [14.610] MAX

3/16 AND 1/4 ATR

1/4 ATR SHOWN


DIM B MAX
DIM C REF
DIM D REF
DIM A
REQUIRES PLATE NUT, TAPPED HOLE OR CLEARANCE FOR [.164] (No.8) SCREW, 4 HOLES.
298.45 [11.750]

3/8 AND 1/2 ATR

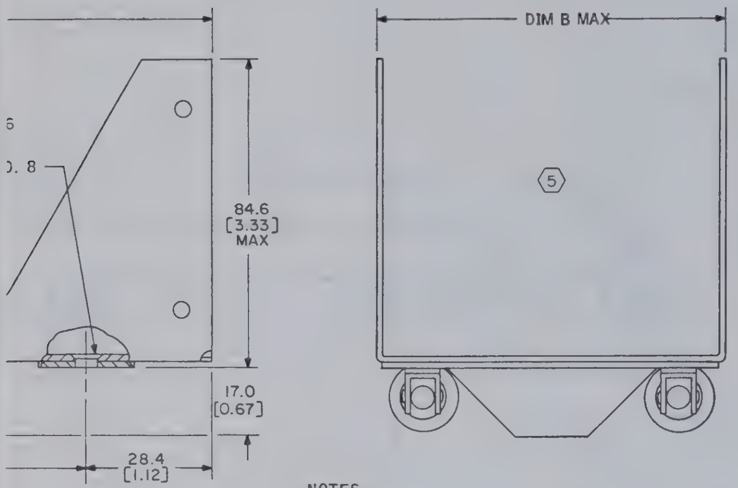
MOUNTING HOLE PATTERN

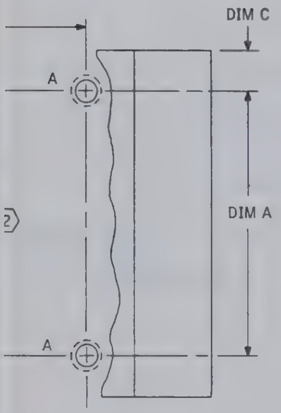
④

PIGGYBACK KIT SIZE	COLLINS P/N	DIM.A	DIM.B	DIM.C	DIM.D	DIM.E	WEIGHT, kg[LBS]
3/16 ATR	634-1104-001	28.58 [1.125]	59.4 [2.34]	29.7 [1.17]	N/A	51.6 [2.03]	0.46 [1.02]
1/4 ATR	634-1104-002	44.45 [1.750]	75.9 [2.99]	37.8 [1.49]	N/A	68.1 [2.68]	0.5 [1.13]
3/8 ATR	634-1104-003	77.77 [3.062]	109.5 [4.31]	18.8 [.74]	71.45 [2.813]	101.3 [3.99]	0.66 [1.44]
1/2 ATR	634-1104-004	111.12 [4.375]	142.7 [5.62]	18.8 [.74]	104.78 [4.125]	134.6 [5.30]	0.76 [1.69]
3/16 ATR (2) OVER 3/8 ATR (1)	634-1104-003	77.77 [3.062]	109.5 [4.31]	18.8 [.74]	71.45 [2.813]	101.3 [3.99]	0.73 [1.60]
1/4 ATR (2) OVER 1/2 ATR (1)	634-1104-004	111.12 [4.375]	142.7 [5.62]	18.8 [.74]	104.78 [4.125]	134.6 [5.30]	0.85 [1.88]

647-3730
TP6-1759-014

UMT-10/11/12/13 Mount, Piggyback Mounting With Cover, Outline and Mounting Dimensions
Figure 2-6





NOTES:

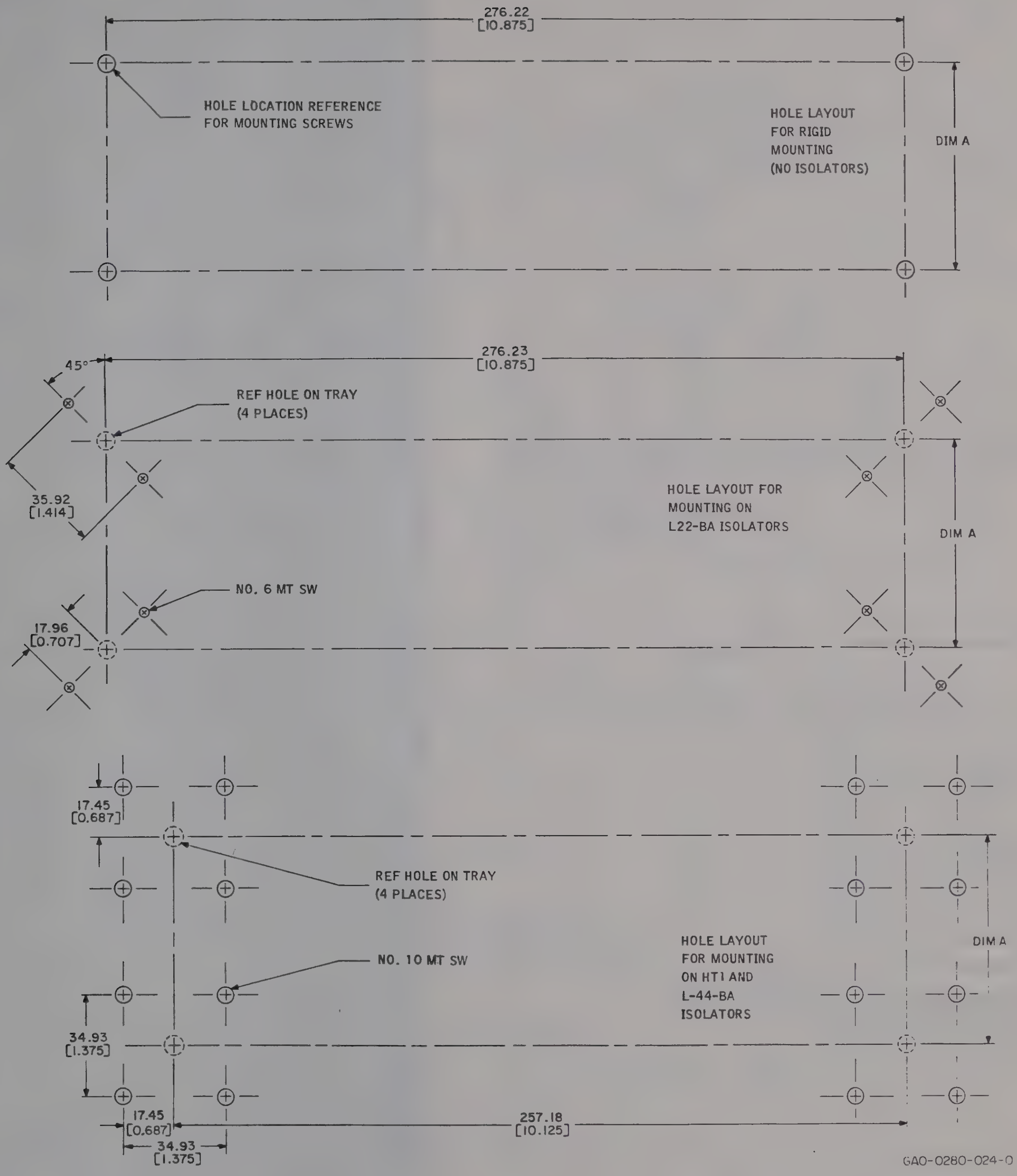
1. DIMENSIONS ARE IN MILLIMETRES [INCHES].
2. BOTTOM VIEW (MOUNTING HOLE DETAIL).
3. THIS MOUNTING HOLE IS INCLUDED ON THE 390R-18 FOR THE SIDE BY SIDE MOUNTING OF A 1/4 AND 3/8 CONFIGURATION. REWORK THE REAR MOUNTING HOLE TO OBTAIN A UNIFORM MOUNTING SCREW SIZE.

EQUIPMENT	COLLINS PART NO.	DIM A	DIM B	DIM C	WEIGHT Kg [LBS]
390R-18	622-1194-001/301 ⟨5⟩	47.62 [1.875]	63.0 [2.48]	7.6 [0.30]	.18 [0.4]
390R-19	622-1195-001/301 ⟨5⟩	71.42 [2.812]	96.3 [3.79]	12.4 [0.49]	.23 [0.5]
390R-20	622-1196-001/301 ⟨5⟩	104.78 [4.125]	129.8 [5.11]	12.4 [0.49]	.23 [0.5]

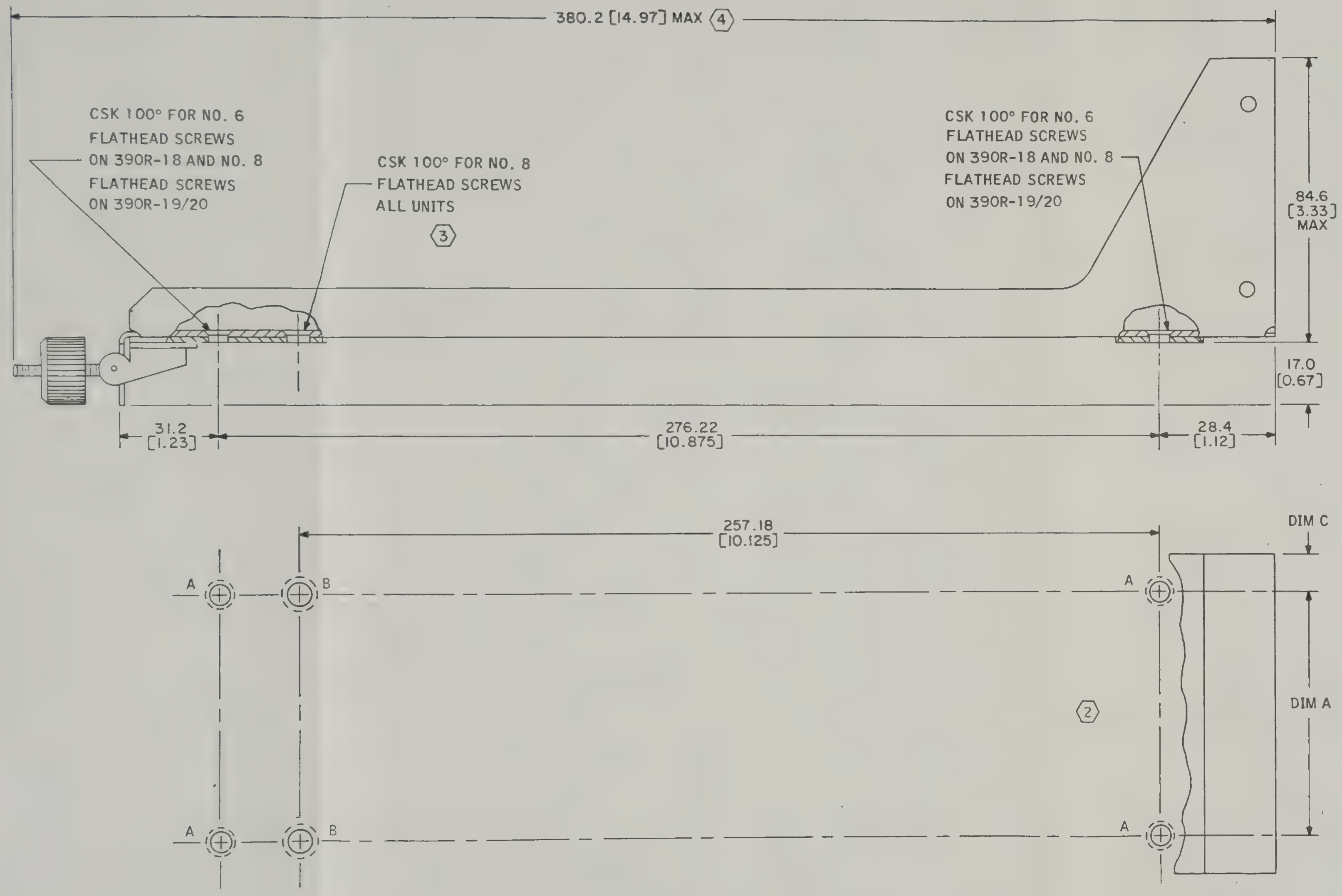
4. WHEN CONNECTOR HOUSING KIT IS INSTALLED, MOUNT MAX LENGTH IS 414.0 [16.30].
5. UNITS WITH PART NUMBERS ENDING IN -301 ARE PROVIDED WITHOUT CONNECTOR MOUNTING PLATES. THE CONNECTOR MOUNTING PLATE FOR THESE UNITS ARE PROVIDED IN THE ASSOCIATED MATING CONNECTOR KITS.
6. OPTIONAL CONNECTOR COVER KITS ARE 621-8533-001 THROUGH -003.

GA0-0280-024-0

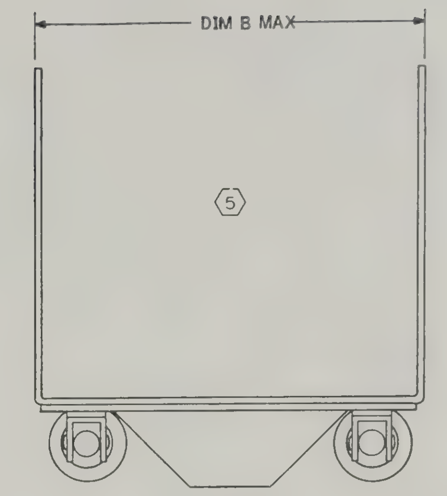
390R-18/19/20 Mounting Tray, Outline and Mounting Dimensions
Figure 2-7 (Sheet 1 of 2)


276.22
[10.875]
HOLE LOCATION REFERENCE
FOR MOUNTING SCREWS
HOLE LAYOUT
FOR RIGID
MOUNTING
(NO ISOLATORS)
DIM A
276.23
[10.875]
45°
REF HOLE ON TRAY
(4 PLACES)
35.92
[1.414]
HOLE LAYOUT FOR
MOUNTING ON
L22-BA ISOLATORS
DIM A
NO. 6 MT SW
17.96
[0.707]
17.45
[0.687]
REF HOLE ON TRAY
(4 PLACES)
NO. 10 MT SW
HOLE LAYOUT
FOR MOUNTING
ON HT1 AND
L-44-BA
ISOLATORS
DIM A
34.93
[1.375]
17.45
[0.687]
34.93
[1.375]
257.18
[10.125]
GAO-0280-024-0

390R-18/19/20 Mounting Tray, Outline and Mounting Dimensions
Figure 2-7 (Sheet 2)



380.2 [14.97] MAX ④
CSK 100° FOR NO. 6 FLATHEAD SCREWS ON 390R-18 AND NO. 8 FLATHEAD SCREWS ON 390R-19/20
CSK 100° FOR NO. 8 FLATHEAD SCREWS ALL UNITS
③
CSK 100° FOR NO. 6 FLATHEAD SCREWS ON 390R-18 AND NO. 8 FLATHEAD SCREWS ON 390R-19/20
84.6 [3.33] MAX
17.0 [0.67]
31.2 [1.23]
276.22 [10.875]
28.4 [1.12]
257.18 [10.125]
DIM C
A
B
A
②
DIM A
A
B
A



NOTES:

① DIMENSIONS ARE IN MILLIMETRES [INCHES].

② BOTTOM VIEW (MOUNTING HOLE DETAIL).

③ THIS MOUNTING HOLE IS INCLUDED ON THE 390R-18 FOR THE SIDE BY SIDE MOUNTING OF A 1/4 AND 3/8 CONFIGURATION. REWORK THE REAR MOUNTING HOLE TO OBTAIN A UNIFORM MOUNTING SCREW SIZE.

EQUIPMENT	COLLINS PART NO.	DIM A	DIM B	DIM C	WEIGHT Kg [LBS]
390R-18	622-1194-001/301 ⑤	47.62 [1.875]	63.0 [2.48]	7.6 [0.30]	.18 [0.4]
390R-19	622-1195-001/301 ⑤	71.42 [2.812]	96.3 [3.79]	12.4 [0.49]	.23 [0.5]
390R-20	622-1196-001/301 ⑤	104.78 [4.125]	129.8 [5.11]	12.4 [0.49]	.23 [0.5]

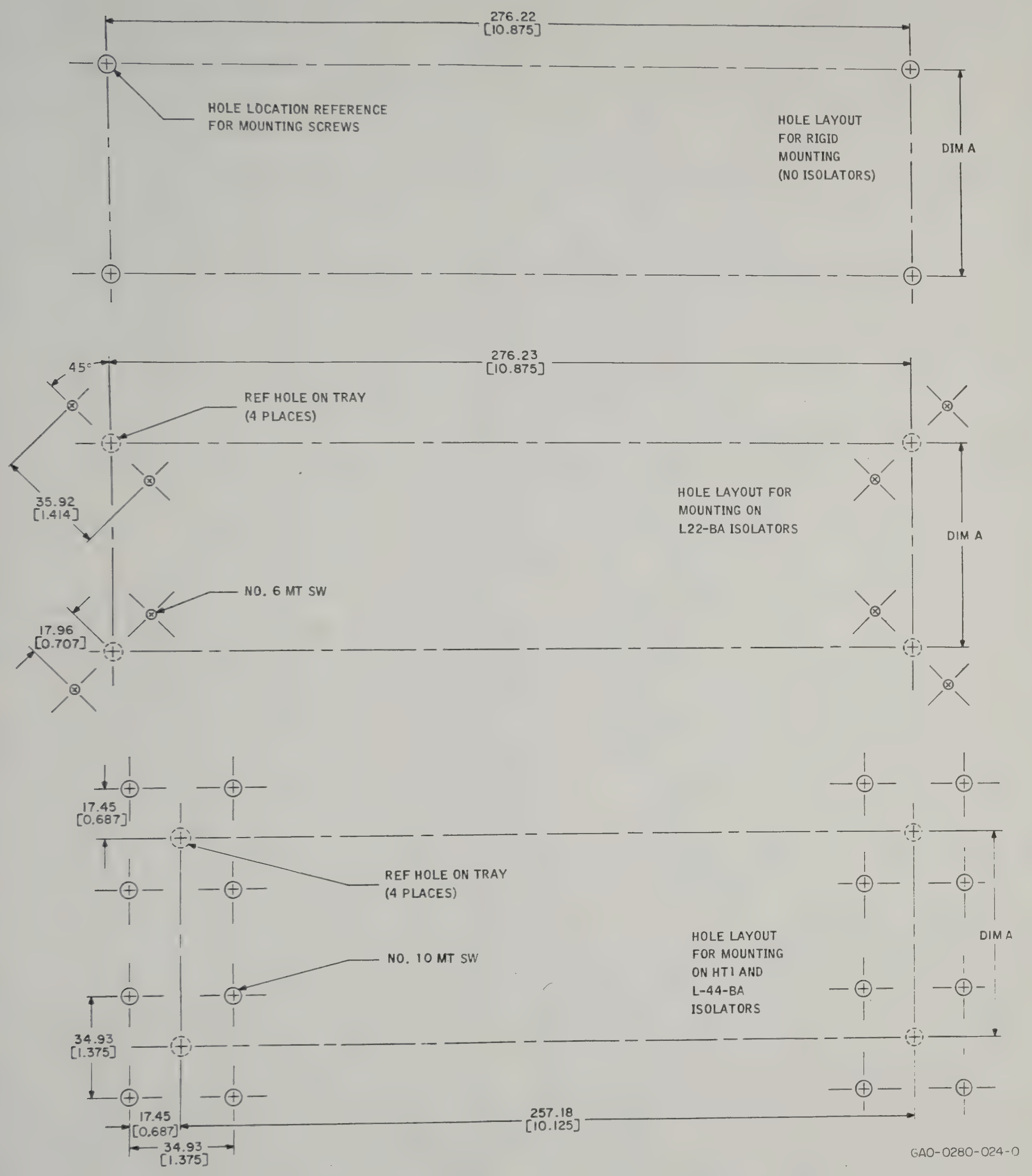
④ WHEN CONNECTOR HOUSING KIT IS INSTALLED, MOUNT MAX LENGTH IS 414.0 [16.30].

⑤ UNITS WITH PART NUMBERS ENDING IN -301 ARE PROVIDED WITHOUT CONNECTOR MOUNTING PLATES. THE CONNECTOR MOUNTING PLATE FOR THESE UNITS ARE PROVIDED IN THE ASSOCIATED MATING CONNECTOR KITS.

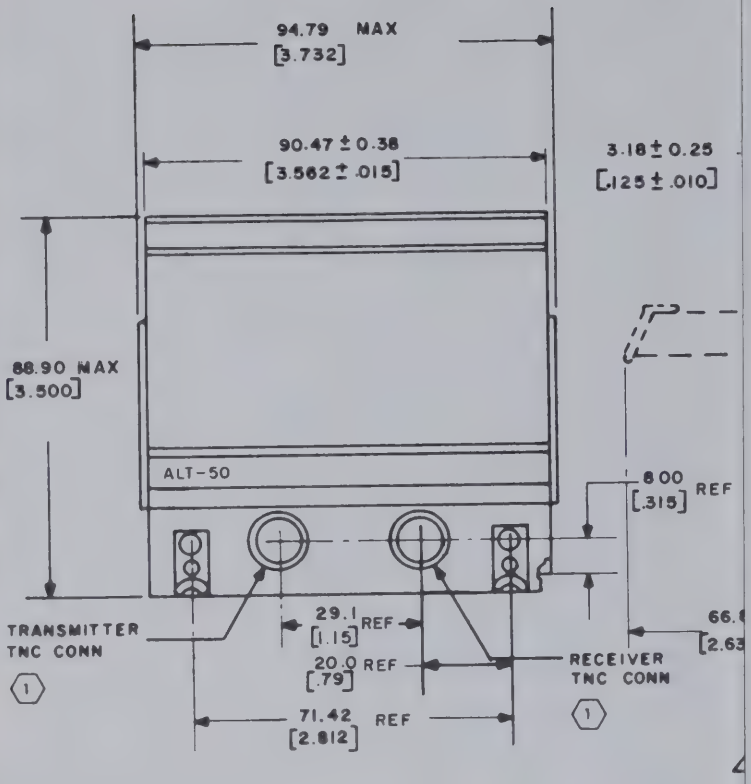
⑥ OPTIONAL CONNECTOR COVER KITS ARE 621-8533-001 THROUGH -003.

GA0-0280-024-0

390R-18/19/20 Mounting Tray, Outline and Mounting Dimensions
Figure 2-7 (Sheet 1 of 2)


276.22
[10.875]
HOLE LOCATION REFERENCE
FOR MOUNTING SCREWS
HOLE LAYOUT
FOR RIGID
MOUNTING
(NO ISOLATORS)
DIM A
45°
276.23
[10.875]
REF HOLE ON TRAY
(4 PLACES)
35.92
[1.414]
HOLE LAYOUT FOR
MOUNTING ON
L22-BA ISOLATORS
DIM A
NO. 6 MT SW
17.96
[0.707]
17.45
[0.687]
REF HOLE ON TRAY
(4 PLACES)
NO. 10 MT SW
HOLE LAYOUT
FOR MOUNTING
ON HT1 AND
L-44-BA
ISOLATORS
DIM A
34.93
[1.375]
17.45
[0.687]
257.18
[10.125]
34.93
[1.375]
GA0-0280-024-0

390R-18/19/20 Mounting Tray, Outline and
Mounting Dimensions
Figure 2-7 (Sheet 2)


94.79 MAX
[3.732]
90.47 ± 0.38
[3.562 ± .015]
3.18 ± 0.25
[.125 ± .010]
88.90 MAX
[3.500]
ALT-50
8.00
[.315] REF
29.1
[1.15] REF
20.0 REF
[.79]
71.42 REF
[2.812]
66.
[2.63
TRANSMITTER
TNC CONN
1
RECEIVER
TNC CONN
1

NOTES:

1. COLLINS PART NO. 357-9516-000.
   MATING CONNECTOR:
   TNC STRAIGHT TO RG-214/U COAXI
   COLLINS PART NO. 357-7204-010.

   OPTIONAL TNC STRAIGHT TO RG-11
   COLLINS PART NO. 357-7450-010.

2. ALL DIMENSIONS ARE IN MILLIM

3. WEIGHT: 5.6 POUNDS. 2.54 KILO

4. UNLESS OTHERWISE SPECIFIED –
   DECIMAL DIMENSION IN INCHES: .
   HOLE DIAMETERS IN INCHES: U
   .2
   OV

   ANGLES: ± 1.0°

   METRIC DIMENSION IN MILLIMETRES: .
   HOLE DIAMETERS IN MILLIMETRES: U
   6.
   OV

   ANGLES: ± 1.0°

5. ECCENTRICITY BETWEEN DIAMETER O
   EXCEED .010 DIAMETER.

6. THE DARKENED SECTION INDICATES

-2069
-8212-013

ALT-50A Radio Altimeter Receiver-Transmitter,
Outline and Mounting Diagram
Figure 2-8

b. Remove safety wire from two knurled knobs that secure ALT-50A to mount.
c. Loosen two knurled knobs and disengage from retainer brackets on ALT-50A.
d. Slide ALT-50A forward until rear connector is disengaged and clear of mount connector.
e. Remove ALT-50A from mount.

2.4.3 339H-4/4A Radio Altitude Indicator

2.4.3.1 Location

The 339H-4/4A Radio Altitude Indicator may be front or rear mounted in the instrument panel. Refer to figure 2-9 for outline and mounting dimensions.

2.4.3.2 Installation

a. Connect 339H-4/4A rear connector to mating connector on wiring harness.
b. Install 339H-4/4A in instrument panel recess and secure with four screws.

2.4.3.3 Removal

a. Remove four screws that secure 339H-4/4A to the instrument panel.
b. Pull 339H-4/4A out of panel recess and disconnect rear connector from mating connector.
c. Remove 339H-4/4A from control panel.

2.4.4 437X-1/1A/1B and ANT-50A/51A/52 Antennas

Refer to figures 2-1 through 2-22 for altimeter antenna outline and mounting dimensions.

Six types of antennas are available for installation in the ALT-50 Radio Altimeter System. The 437X-1, ANT-50A, or ANT-51A is used when the mounting surface is relatively flat. The 437X-1A or 437X-1B is used when the mounting surface is curved. The 437X-1A fits a curved surface with a radius of 180.34 cm (71 in); the 437X-1B fits a radius of 81.23 cm (32 in). The ANT-52, because of its relatively small size, can be used on either a flat or curved surface. The altimeter system requires two antennas, one for transmit and one for receive.

2.4.4.1 Location

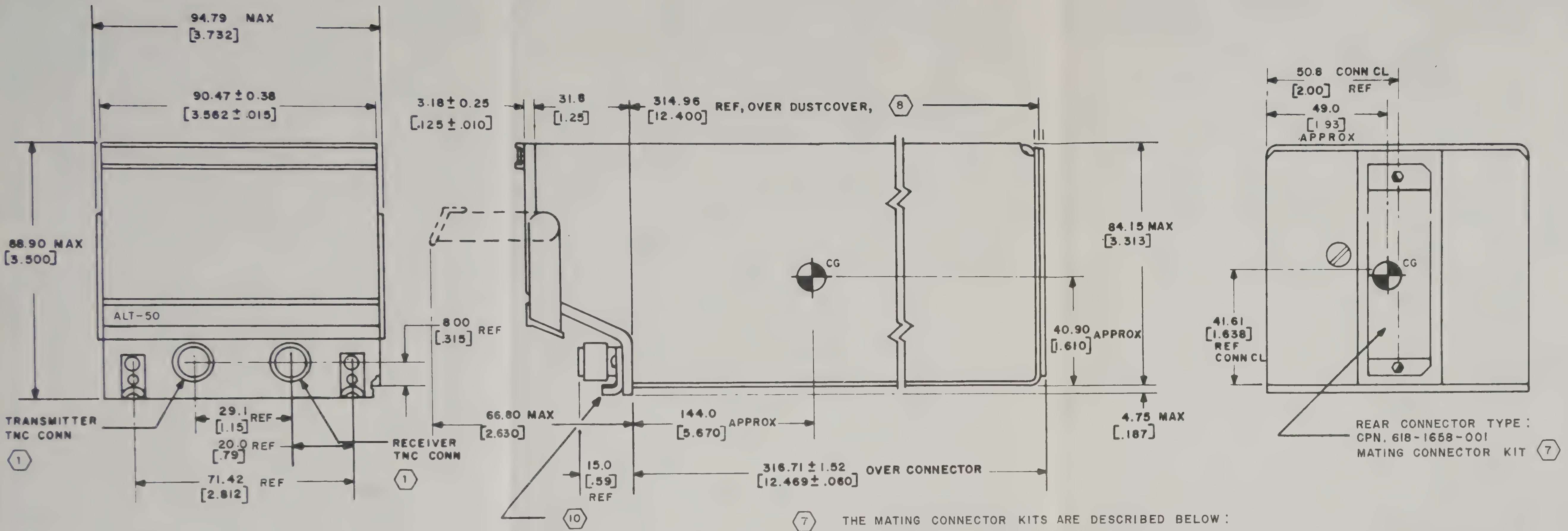
The antennas should be mounted on the underside of the aircraft, positioned as near the point of rotation as possible. Mounting the antenna near the point of rotation reduces the change in altitude readings due to aircraft pitch attitude during approach and landing. The location must provide a clearance cone from the antenna of not less than 120 degrees.

2.4.4.2 Mounting

The 437X-1, ANT-50A, ANT-51A, and ANT-52 Antennas can be mounted either side by side or in line. The 437X-1A and 437X-1B Antennas can be mounted only in line. Refer to figure 2-10 for typical mounting placement. The antennas must be separated by no more than the antenna height above the terrain at touchdown, but should be separated by at least 50.8 cm (20 in) (measured between antenna center lines). The antennas should always be installed as far apart as possible but not more than the antenna height above the terrain at touchdown. Otherwise, insufficient terrain area is illuminated for ground level operation. If a dual system is installed, the transmit antennas from one system must be located as far as possible from the receive antenna of the other system. Except for the ANT-52, the antennas should be mounted with the connectors perpendicular to a line between the transmit and receive antennas to minimize antenna-to-antenna signal leakage. The signal leakage should be at least 6 dB below the signal level required for operation. The surface area between the transmit and receive antennas must be smooth and free from discontinuities.

The combined squint angle of both transmit and receive antennas must not exceed 6 degrees. This angle is measured from the physical axis of the antenna to a vertical line from the aircraft to the reflecting terrain. In the case of antennas mounted side by side and on either side of the aircraft center line, and depending on the symmetry and curvature of the fuselage, the antennas can be pointing in opposite directions, each by the same angle. In this case, the angle by which one antenna is tilted away from the vertical cannot exceed 3 degrees (6 degrees from the other antenna). In the case of in-line mounting, the antennas will (most likely) be pointing in the same direction, left or right (if not straight down), so that the squint angle of one will be nearly the same as the other in magnitude and direction. In this case, the angle from the vertical can be as much as 6 degrees for either or both antennas.

For all antennas except the ANT-52, the mounting hole in line with the connector should be marked with black paint on the face of the antenna before installation. This facilitates orientation of the antenna in the aircraft. These antennas should be oriented so that the antenna connectors are pointed in the same direction and at 90 degrees to the center


94.79 MAX
[3.732]
90.47 ± 0.38
[3.562 ± .015]
88.90 MAX
[3.500]
ALT-50
TRANSMITTER
TNC CONN
①
29.1
[1.15]
REF
20.0 REF
[.79]
71.42 REF
[2.812]
RECEIVER
TNC CONN
①
8.00
[.315] REF
3.18 ± 0.25
[.125 ± .010]
31.8
[1.25]
314.96
[12.400]
REF, OVER DUSTCOVER, ⑧
CG
84.15 MAX
[3.313]
40.90
[1.610]
APPROX
4.75 MAX
[.187]
66.80 MAX
[2.630]
144.0
[5.670]
APPROX
15.0
[.59]
REF
316.71 ± 1.52
[12.469 ± .060]
OVER CONNECTOR
⑩
50.8 CONN CL
[2.00] REF
49.0
[1.93]
APPROX
CG
41.61
[1.638]
REF
CONN CL
REAR CONNECTOR TYPE:
CPN. 618-1658-001
MATING CONNECTOR KIT ⑦

⑦ THE MATING CONNECTOR KITS ARE DESCRIBED BELOW:

DESCRIPTION	CPN	CONNECTOR KIT			
		390R-19		UMT-12	
		634-1898-001	634-4193-008	634-1021-001	634-4192-006
CONNECTOR, MALE	634-1112-001	1	1	1	1
CONTACT	372-2514-110		30		30
CONNECTOR, KEYWAY	634-1116-001	2	2	2	2
RING, CAPTIVE - KEYWAY	634-1117-001	2	2	3	3
CONNECTOR, TNC MALE	357-7204-010		2		2
ASSEMBLY, CONNECTOR PLATE	634-1130-003		1		
SCREW, HEX SKT, 4-40 X 3/8	324-2605-000	2	2		2
WASHER, FLAT 0.123 X 0.247	310-0779-030	2	2		
ENVELOPE, DWN	520-8360-262	1	1	1	1
INSERT, FASTENER	334-2117-010			2	2
ASSEMBLY, CONNECTOR PLATE	634-3387-005	1			
SCREW, HEX SKT, 4-40 X 3/8	324-2604-000			2	

⑧ DUST COVER SHALL NOT EXTEND BEYOND CONNECTOR.

⑨ UNIT CAN BE MOUNTED USING 390R-19 UNIVERSAL MOUNT, COLLINS PART NUMBER 622-1195-001 OR UMT-12 MOUNT, COLLINS PART NUMBER 622-5212-001 PLUS APPLICABLE MATING CONNECTOR AND OPTIONAL ISOLATORS.

⑩ OUTLINE AND INSTALLATION DATA GIVEN IS IN ACCORDANCE WITH ARING CHARACTERISTIC 404.

NOTES:

① COLLINS PART NO. 357-9516-000.
MATING CONNECTOR:
TNC STRAIGHT TO RG-214/U COAXIAL CABLE.
COLLINS PART NO. 357-7204-010.

OPTIONAL TNC STRAIGHT TO RG-115 A/U COAXIAL CABLE,
COLLINS PART NO. 357-7450-010.

② **ALL DIMENSIONS ARE IN MILLIMETRES [INCHES].**

③ **WEIGHT: 5.6 POUNDS. 2.54 KILOGRAMS.**

④ **UNLESS OTHERWISE SPECIFIED – TOLERANCES ON:**
DECIMAL DIMENSION IN INCHES: .XX = ± .02, .XXX = ± .008
HOLE DIAMETERS IN INCHES: UNDER .251 DIA = + .005 - .005
.251 TO .500 DIA = ± .006 - .005
OVER .500 DIA = + .008 - .005

ANGLES: ± 1.0°

METRIC DIMENSION IN MILLIMETRES: .X = ± 0.5, .XX = ± 0.2
HOLE DIAMETERS IN MILLIMETRES: UNDER 6.38 Ø = + 0.13 - 0.13
6.38 TO 12.7 Ø = + 0.15 - 0.13
OVER 12.7 Ø = + 0.20 - 0.13

ANGLES: ± 1.0°

⑤ ECCENTRICITY BETWEEN DIAMETER ON AN AXIS NOT TO EXCEED .010 DIAMETER.

⑥ THE DARKENED SECTION INDICATES OPEN PORTION OF KEYWAY.

637-2069
TP4-8212-013

ALT-50A Radio Altimeter Receiver-Transmitter,
Outline and Mounting Diagram
Figure 2-8

b. Remove safety wire from two knurled knobs that secure ALT-50A to mount.
c. Loosen two knurled knobs and disengage from retainer brackets on ALT-50A.
d. Slide ALT-50A forward until rear connector is disengaged and clear of mount connector.
e. Remove ALT-50A from mount.

2.4.3 339H-4/4A Radio Altitude Indicator

2.4.3.1 Location

The 339H-4/4A Radio Altitude Indicator may be front or rear mounted in the instrument panel. Refer to figure 2-9 for outline and mounting dimensions.

2.4.3.2 Installation

a. Connect 339H-4/4A rear connector to mating connector on wiring harness.
b. Install 339H-4/4A in instrument panel recess and secure with four screws.

2.4.3.3 Removal

a. Remove four screws that secure 339H-4/4A to the instrument panel.
b. Pull 339H-4/4A out of panel recess and disconnect rear connector from mating connector.
c. Remove 339H-4/4A from control panel.

2.4.4 437X-1/1A/1B and ANT-50A/51A/52 Antennas

Refer to figures 2-1 through 2-22 for altimeter antenna outline and mounting dimensions.

Six types of antennas are available for installation in the ALT-50 Radio Altimeter System. The 437X-1, ANT-50A, or ANT-51A is used when the mounting surface is relatively flat. The 437X-1A or 437X-1B is used when the mounting surface is curved. The 437X-1A fits a curved surface with a radius of 180.34 cm (71 in); the 437X-1B fits a radius of 81.23 cm (32 in). The ANT-52, because of its relatively small size, can be used on either a flat or curved surface. The altimeter system requires two antennas, one for transmit and one for receive.

2.4.4.1 Location

The antennas should be mounted on the underside of the aircraft, positioned as near the point of rotation as possible. Mounting the antenna near the point of rotation reduces the change in altitude readings due to aircraft pitch attitude during approach and landing. The location must provide a clearance cone from the antenna of not less than 120 degrees.

2.4.4.2 Mounting

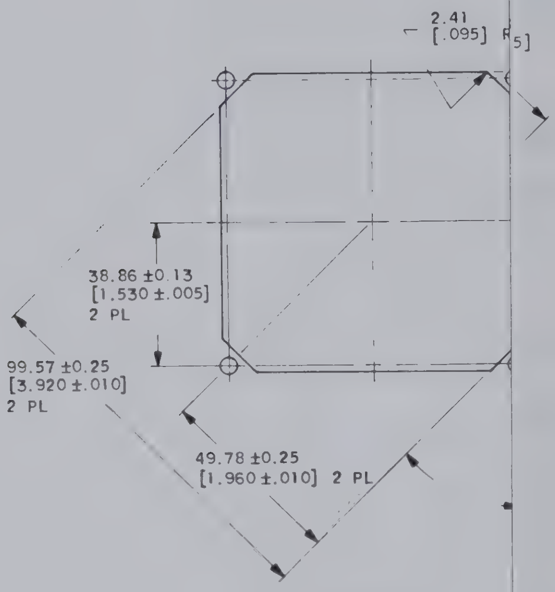
The 437X-1, ANT-50A, ANT-51A, and ANT-52 Antennas can be mounted either side by side or in line. The 437X-1A and 437X-1B Antennas can be mounted only in line. Refer to figure 2-10 for typical mounting placement. The antennas must be separated by no more than the antenna height above the terrain at touchdown, but should be separated by at least 50.8 cm (20 in) (measured between antenna center lines). The antennas should always be installed as far apart as possible but not more than the antenna height above the terrain at touchdown. Otherwise, insufficient terrain area is illuminated for ground level operation. If a dual system is installed, the transmit antennas from one system must be located as far as possible from the receive antenna of the other system. Except for the ANT-52, the antennas should be mounted with the connectors perpendicular to a line between the transmit and receive antennas to minimize antenna-to-antenna signal leakage. The signal leakage should be at least 6 dB below the signal level required for operation. The surface area between the transmit and receive antennas must be smooth and free from discontinuities.

The combined squint angle of both transmit and receive antennas must not exceed 6 degrees. This angle is measured from the physical axis of the antenna to a vertical line from the aircraft to the reflecting terrain. In the case of antennas mounted side by side and on either side of the aircraft center line, and depending on the symmetry and curvature of the fuselage, the antennas can be pointing in opposite directions, each by the same angle. In this case, the angle by which one antenna is tilted away from the vertical cannot exceed 3 degrees (6 degrees from the other antenna). In the case of in-line mounting, the antennas will (most likely) be pointing in the same direction, left or right (if not straight down), so that the squint angle of one will be nearly the same as the other in magnitude and direction. In this case, the angle from the vertical can be as much as 6 degrees for either or both antennas.

For all antennas except the ANT-52, the mounting hole in line with the connector should be marked with black paint on the face of the antenna before installation. This facilitates orientation of the antenna in the aircraft. These antennas should be oriented so that the antenna connectors are pointed in the same direction and at 90 degrees to the center

NOTES:

1. DIMENSIONS ARE IN MILLIMETRES [INCHES].
2. WEIGHT: 0.68 kg [1.5 LB] MAX.
3. THIS DRAWING IS APPLICABLE TO 339H-4, COLLINS PART NUMBER 622-1204-008.
4. MATING CONNECTOR: PT06A-14-19S(SR). COLLINS PART NUMBER 371-8087-
5. MOUNTING ARRANGEMENT:
   FRONT MOUNTING:
   - A. MOORING PLATE-CPN 553-6588-004.
   - B. TAPPED INSTRUMENT PANEL NO.6-32 UNC-2A.
6. REAR MOUNTING:
   - A. MOORING PLATE-CPN 553-6588-004.


2.41
[.095] R
5]
38.86 ±0.13
[1.530 ±.005]
2 PL
99.57 ±0.25
[3.920 ±.010]
2 PL
49.78 ±0.25
[1.960 ±.010] 2 PL

PANEL CUTOUT

339H-4/4A Radio Altitude Indicator,
Outline and Mounting Diagram
Figure 2-9

line between antennas. The ANT-52 antenna has a small arrow painted on the face. These antennas should be mounted so that the arrows are in line, pointing directly toward or directly away from each other.

The antenna mating flange and aircraft surface must be free of paint or other insulation materials to provide a continuous ground path. Improper grounding results in side-lobe radiation. Do not remove the chromate finish from the antennas or the aircraft structure, as it provides adequate grounding and protects the aluminum from corrosion.

In certain aircraft installations, the possibility of undesirable side-lobe radiation effects may necessitate that the antennas be installed with rf bonding gaskets between the aircraft fuselage and the antenna. An rf gasket constructed of aluminum wire cloth, impregnated with silicone rubber and made of type 40-8520 material, from Metex Electronic Corporation, or equivalent, may be used. Precut antenna ground gaskets also are available from Collins General Aviation Division under the part numbers shown in table 2-1.

Table 2-1. Radio Altimeter Antenna Gaskets Available.

ANTENNA	GASKET COLLINS PART NO
437X-1	018-1394-020
437X-1A	018-1394-020
437X-1B (622-0954-001)	018-1394-030
437X-1B (622-0954-002)	018-1394-040
ANT-50A	018-1394-060
ANT-51A	018-1394-020
ANT-52	018-1394-100

2.4.4.3 Installation

a. Install antenna ground gasket on 437X-1/1A/1B or ANT-50/51A/52 Antennas.
b. Install antenna in airframe with TNC connector facing antenna cable, and secure with 8 screws for 437X-1/1A/1B and ANT-51A Antennas, 12 screws for ANT-50A Antenna, and 4 screws for ANT-52 Antenna.
c. Connect antenna cable TNC connector to antenna connector and safety-wire.
d. Repeat steps a through c for second antenna.

2.4.4.4 Removal

a. Remove safety wire from TNC connector and disconnect antenna cable from antenna.
b. Remove screws and antenna from airframe. Do not disturb grounding gasket unless gasket or antenna is being replaced.
c. Repeat steps a and b for second antenna.

2.4.5 DRI-55 Digital Radio Altitude Indicator

2.4.5.1 Location

The DRI-55 Digital Radio Altitude Indicator may be front or rear mounted. Refer to figure 2-23 for outline and mounting dimensions.

2.4.5.2 Installation

a. Connect DRI-55 rear connector to mating connector on wiring harness.
b. Install DRI-55 in instrument panel recess and secure with integral turnlock fasteners or with four screws.

2.4.5.3 Removal

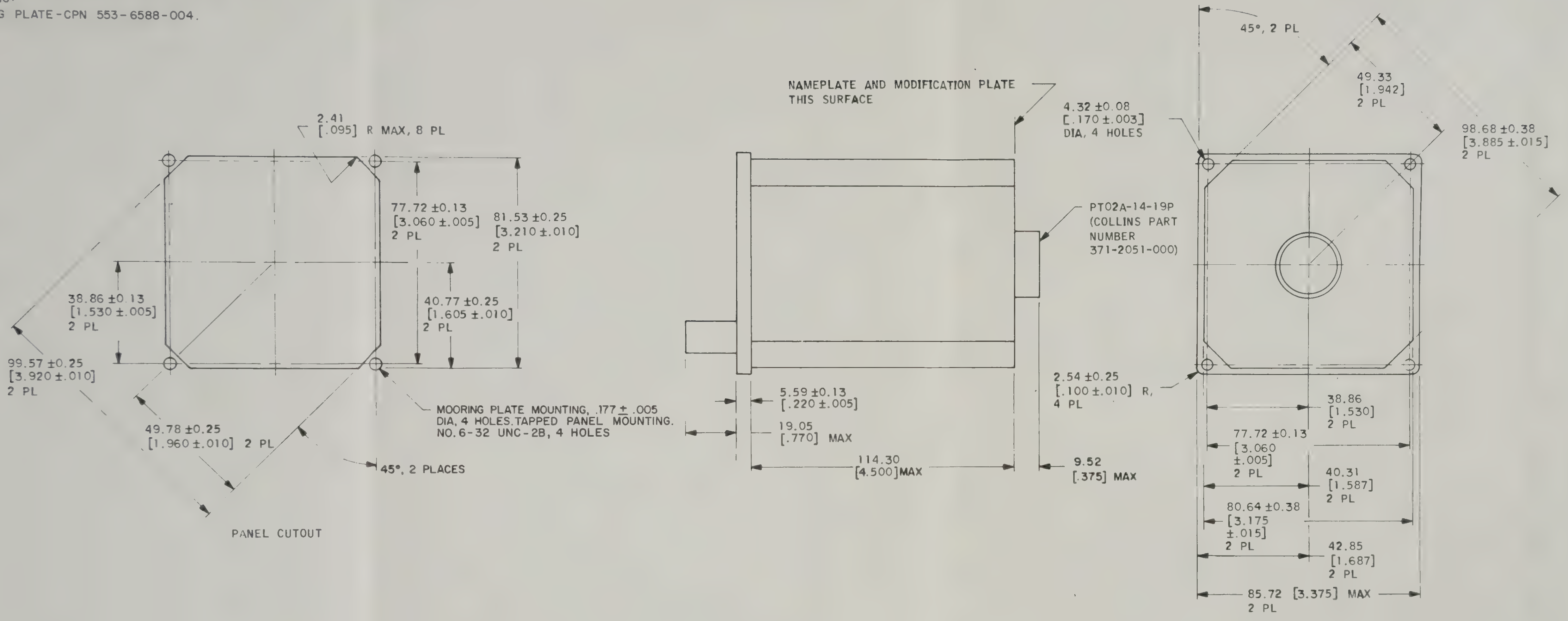
a. Remove four screws, or loosen integral turnlock fasteners that secure DRI-55 to the panel.
b. Remove DRI-55 from panel recess and disconnect rear connector from mating connector.

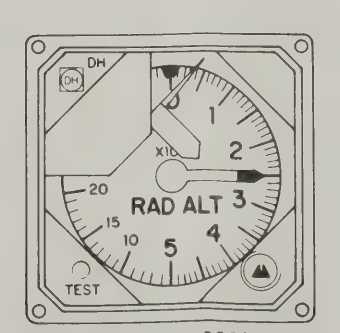
2.5 POSTINSTALLATION CHECK

a. Turn on aircraft primary power.
b. Adjust DH knob on indicator to set DH index to 25 feet.
c. Depress TEST switch on indicator and observe indicator. Indicator altitude should be 50 feet and the flag should be in view.
d. Adjust DH knob to increase DH index altitude while depressing TEST switch. DH indicator should light at 45 to 55 feet and remain lit at all altitudes above 50 feet.
e. With TEST switch released, read altitude indicated on indicator. Altitude should be -5 to +5 feet. In some installations, the tolerance may be greater due to antenna location and difference between aircraft touchdown attitude and parked attitude.
f. Turn off aircraft primary power.

NOTES:

1. DIMENSIONS ARE IN MILLIMETRES [INCHES].
2. WEIGHT: 0.68 kg [1.5 LB] MAX.
3. THIS DRAWING IS APPLICABLE TO 339H-4, COLLINS PART NUMBER 622-1204-008.
4. MATING CONNECTOR: PT06A-14-19S(SR). COLLINS PART NUMBER 371-8087-000.
5. MOUNTING ARRANGEMENT:
   FRONT MOUNTING:
   - A. MOORING PLATE-CPN 553-6588-004.
   - B. TAPPED INSTRUMENT PANEL NO.6-32 UNC-2A.
6. REAR MOUNTING:
   - A. MOORING PLATE-CPN 553-6588-004.


2.41
[.095] R MAX, 8 PL
77.72 ±0.13
[3.060 ±.005]
2 PL
81.53 ±0.25
[3.210 ±.010]
2 PL
38.86 ±0.13
[1.530 ±.005]
2 PL
40.77 ±0.25
[1.605 ±.010]
2 PL
99.57 ±0.25
[3.920 ±.010]
2 PL
49.78 ±0.25
[1.960 ±.010] 2 PL
MOORING PLATE MOUNTING, .177 ± .005 DIA, 4 HOLES.TAPPED PANEL MOUNTING. NO.6-32 UNC-2B, 4 HOLES
45°, 2 PLACES
PANEL CUTOUT
NAMEPLATE AND MODIFICATION PLATE THIS SURFACE
PT02A-14-19P (COLLINS PART NUMBER 371-2051-000)
5.59 ±0.13
[.220 ±.005]
19.05
[.770] MAX
114.30
[4.500]MAX
9.52
[.375] MAX
2.54 ±0.25
[.100 ±.010] R,
4 PL
45°, 2 PL
49.33
[1.942]
2 PL
4.32 ±0.08
[.170 ±.003]
DIA, 4 HOLES
98.68 ±0.38
[3.885 ±.015]
2 PL
38.86
[1.530]
2 PL
77.72 ±0.13
[3.060
±.005]
2 PL
40.31
[1.587]
2 PL
80.64 ±0.38
[3.175
±.015]
2 PL
42.85
[1.687]
2 PL
85.72 [3.375] MAX
2 PL


DH
DH
1
2
3
4
5
X10
20
15
10
RAD ALT
TEST

339H-4 (622-1204-008)
INDICATOR FACE DETAIL

TP6-0931-014

339H-4/4A Radio Altitude Indicator,
Outline and Mounting Diagram
Figure 2-9

line between antennas. The ANT-52 antenna has a small arrow painted on the face. These antennas should be mounted so that the arrows are in line, pointing directly toward or directly away from each other.

The antenna mating flange and aircraft surface must be free of paint or other insulation materials to provide a continuous ground path. Improper grounding results in side-lobe radiation. Do not remove the chromate finish from the antennas or the aircraft structure, as it provides adequate grounding and protects the aluminum from corrosion.

In certain aircraft installations, the possibility of undesirable side-lobe radiation effects may necessitate that the antennas be installed with rf bonding gaskets between the aircraft fuselage and the antenna. An rf gasket constructed of aluminum wire cloth, impregnated with silicone rubber and made of type 40-8520 material, from Metex Electronic Corporation, or equivalent, may be used. Precut antenna ground gaskets also are available from Collins General Aviation Division under the part numbers shown in table 2-1.

Table 2-1. Radio Altimeter Antenna Gaskets Available.

ANTENNA	GASKET COLLINS PART NO
437X-1	018-1394-020
437X-1A	018-1394-020
437X-1B (622-0954-001)	018-1394-030
437X-1B (622-0954-002)	018-1394-040
ANT-50A	018-1394-060
ANT-51A	018-1394-020
ANT-52	018-1394-100

2.4.4.3 Installation

a. Install antenna ground gasket on 437X-1/1A/1B or ANT-50/51A/52 Antennas.
b. Install antenna in airframe with TNC connector facing antenna cable, and secure with 8 screws for 437X-1/1A/1B and ANT-51A Antennas, 12 screws for ANT-50A Antenna, and 4 screws for ANT-52 Antenna.
c. Connect antenna cable TNC connector to antenna connector and safety-wire.
d. Repeat steps a through c for second antenna.

2.4.4.4 Removal

a. Remove safety wire from TNC connector and disconnect antenna cable from antenna.
b. Remove screws and antenna from airframe. Do not disturb grounding gasket unless gasket or antenna is being replaced.
c. Repeat steps a and b for second antenna.

2.4.5 DRI-55 Digital Radio Altitude Indicator

2.4.5.1 Location

The DRI-55 Digital Radio Altitude Indicator may be front or rear mounted. Refer to figure 2-23 for outline and mounting dimensions.

2.4.5.2 Installation

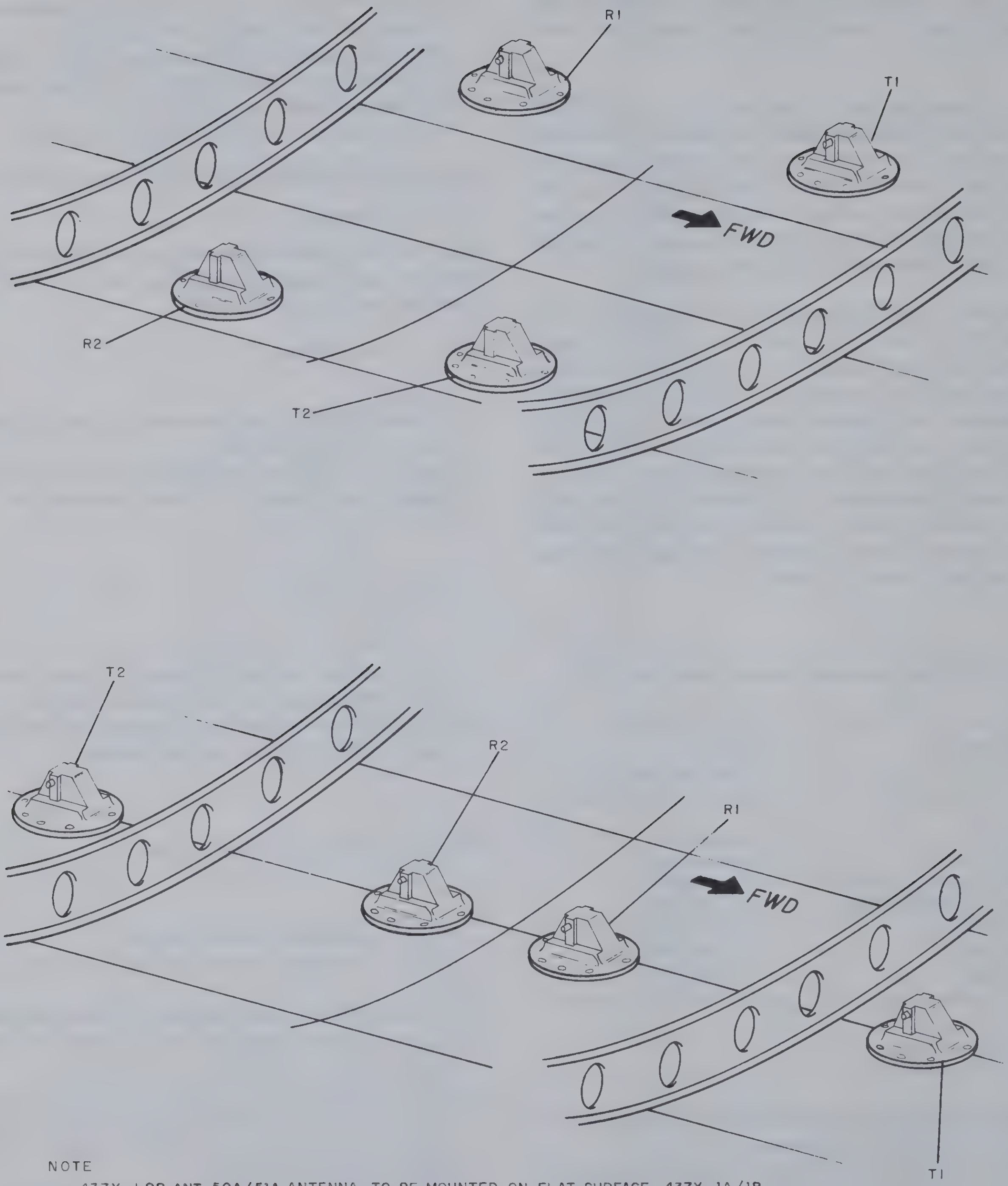
a. Connect DRI-55 rear connector to mating connector on wiring harness.
b. Install DRI-55 in instrument panel recess and secure with integral turnlock fasteners or with four screws.

2.4.5.3 Removal

a. Remove four screws, or loosen integral turnlock fasteners that secure DRI-55 to the panel.
b. Remove DRI-55 from panel recess and disconnect rear connector from mating connector.

2.5 POSTINSTALLATION CHECK

a. Turn on aircraft primary power.
b. Adjust DH knob on indicator to set DH index to 25 feet.
c. Depress TEST switch on indicator and observe indicator. Indicator altitude should be 50 feet and the flag should be in view.
d. Adjust DH knob to increase DH index altitude while depressing TEST switch. DH indicator should light at 45 to 55 feet and remain lit at all altitudes above 50 feet.
e. With TEST switch released, read altitude indicated on indicator. Altitude should be -5 to +5 feet. In some installations, the tolerance may be greater due to antenna location and difference between aircraft touchdown attitude and parked attitude.
f. Turn off aircraft primary power.

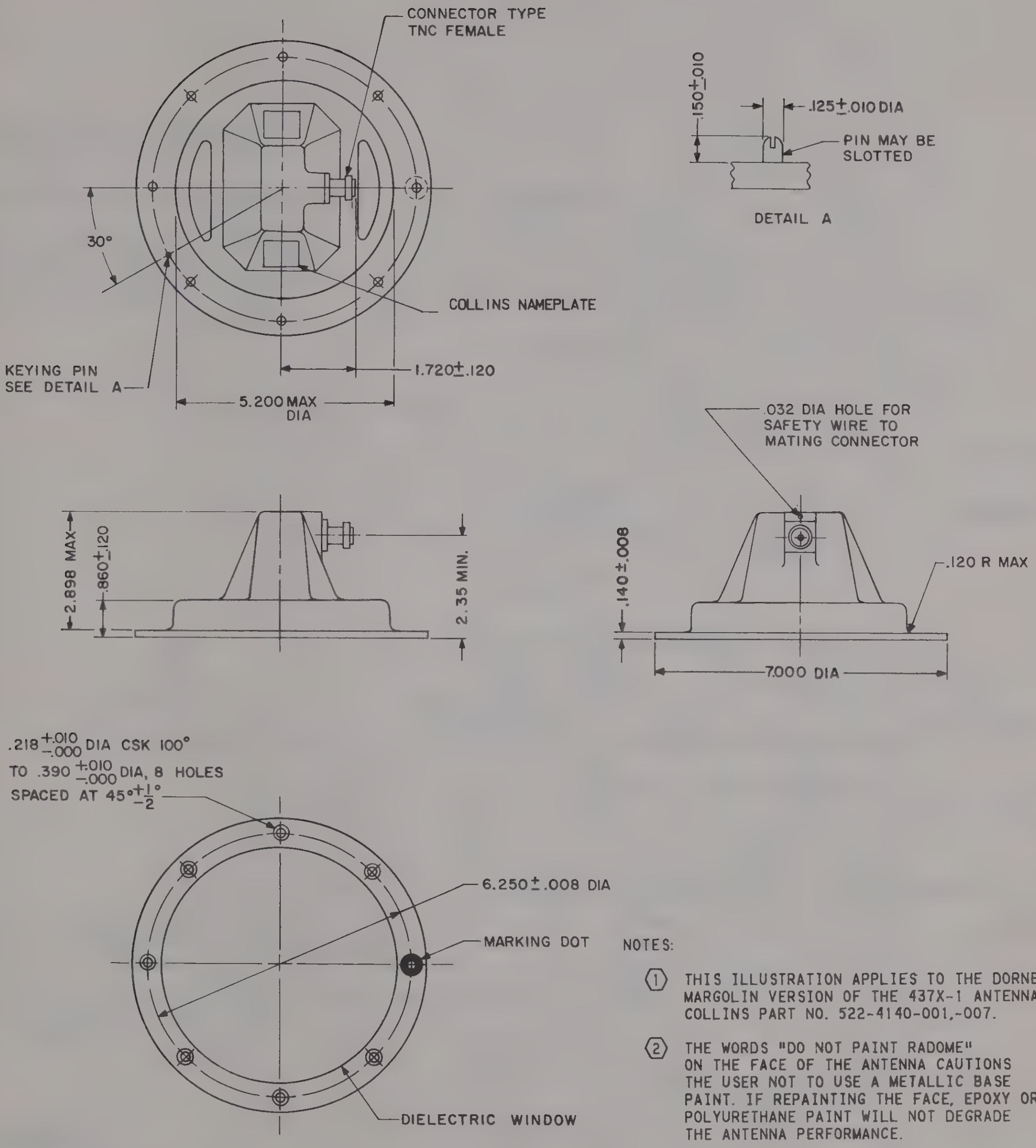


NOTE

437X-1 OR ANT-50A/51A ANTENNA TO BE MOUNTED ON FLAT SURFACE, 437X-1A/1B ANTENNA TO BE MOUNTED ON CURVED SURFACE, AND ANT-52 TO BE MOUNTED ON CURVED OR FLAT SURFACE. 437X-1A/1B ANTENNAS CANNOT BE MOUNTED SIDE BY SIDE.

TP2-1411-013

437X-1/1A/1B ANT-50A/51A/52 Antenna, Typical Installation
Figure 2-10


CONNECTOR TYPE
TNC FEMALE
30°
COLLINS NAMEPLATE
KEYING PIN
SEE DETAIL A
1.720±.120
5.200 MAX
DIA
.150±.010
.125±.010 DIA
PIN MAY BE
SLOTTED
DETAIL A
.032 DIA HOLE FOR
SAFETY WIRE TO
MATING CONNECTOR
2.898 MAX
.860±.120
2.35 MIN.
.140±.008
.120 R MAX
7.000 DIA
.218 +.010 -.000 DIA CSK 100°
TO .390 +.010 -.000 DIA, 8 HOLES
SPACED AT 45° +1/2°
6.250±.008 DIA
MARKING DOT
DIELECTRIC WINDOW

NOTES:

① THIS ILLUSTRATION APPLIES TO THE DORNE AND MARGOLIN VERSION OF THE 437X-1 ANTENNA, COLLINS PART NO. 522-4140-001,-007.

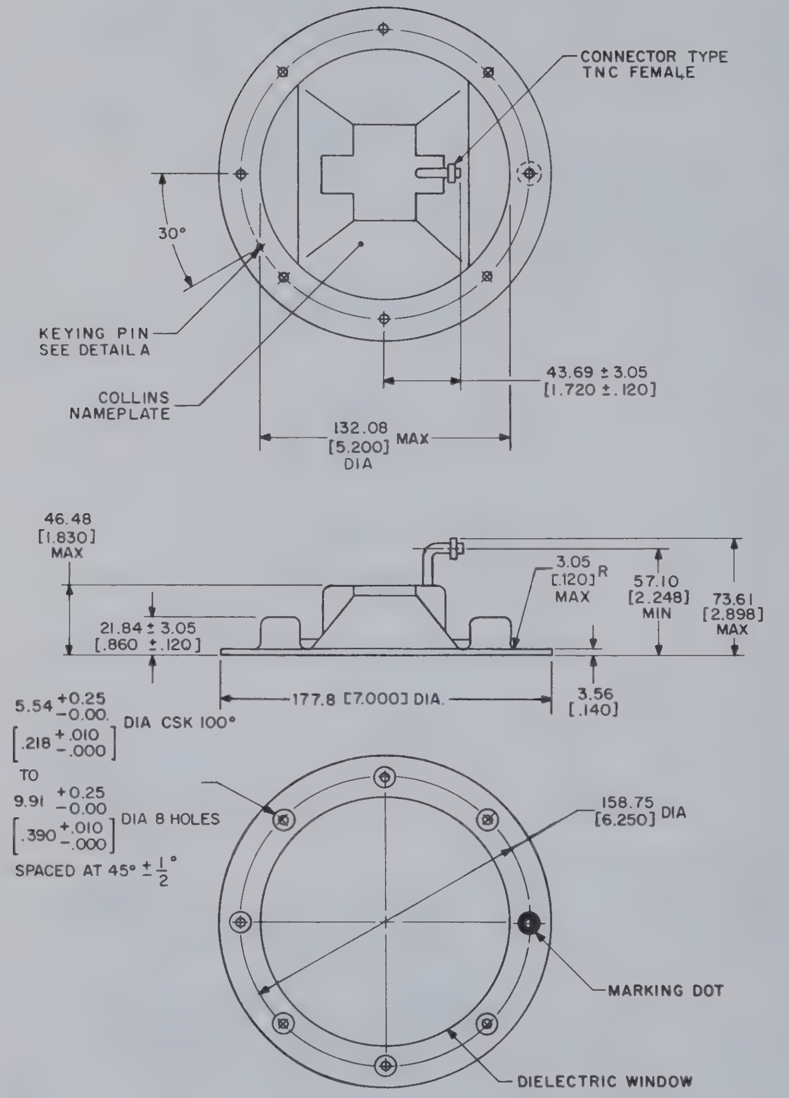
② THE WORDS "DO NOT PAINT RADOME" ON THE FACE OF THE ANTENNA CAUTIONS THE USER NOT TO USE A METALLIC BASE PAINT. IF REPAINTING THE FACE, EPOXY OR POLYURETHANE PAINT WILL NOT DEGRADE THE ANTENNA PERFORMANCE.

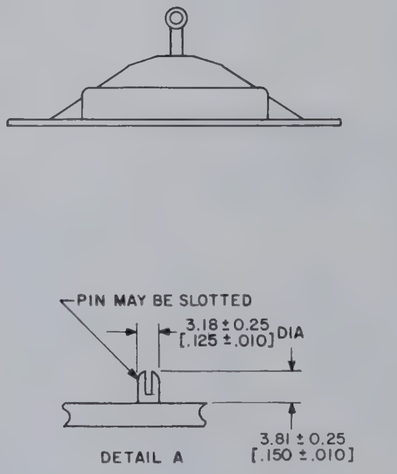
768-1566-C

437X-1 Antenna (CPN 522-4140-001/007),
Outline and Mounting Diagram
Figure 2-11 (Sheet 1 of 2)

NOTES:

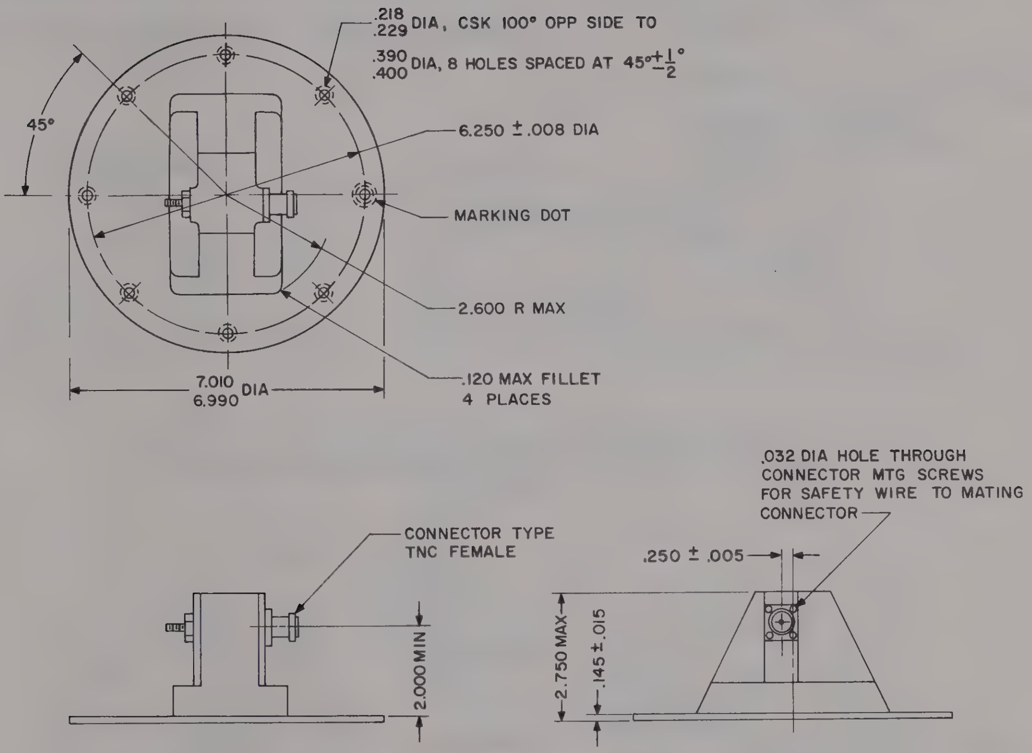
1. THIS ILLUSTRATION APPLIES TO THE UB CORPORATION VERSION OF THE 437X-1 ANTENNA, CPN 522-4140-001,-006.
2. DIMENSIONS ARE IN MILLIMETERS [INCHES].
3. THE WORDS "DO NOT PAINT RADOME" ON THE FACE OF THE ANTENNA CAUTIONS THE USER NOT TO USE A METALLIC BASE PAINT IF REPAINTING THE FACE. EPOXY OR POLYURETHANE PAINT WILL NOT DEGRADE THE ANTENNA PERFORMANCE.


CONNECTOR TYPE TNC FEMALE
30°
KEYING PIN SEE DETAIL A
COLLINS NAMEPLATE
43.69 ± 3.05 [1.720 ± .120]
132.08 [5.200] MAX DIA
46.48 [1.830] MAX
3.05 [.120] R MAX
57.10 [2.248] MIN
73.61 [2.898] MAX
21.84 ± 3.05 [.860 ± .120]
177.8 [7.000] DIA.
3.56 [.140]
5.54 +0.25 −0.00 [.218 +.010 −.000] DIA CSK 100°
TO
9.91 +0.25 −0.00 [.390 +.010 −.000] DIA 8 HOLES
SPACED AT 45° ± 1/2°
158.75 [6.250] DIA
MARKING DOT
DIELECTRIC WINDOW


PIN MAY BE SLOTTED
3.18 ± 0.25 [.125 ± .010] DIA
3.81 ± 0.25 [.150 ± .010]
DETAIL A

768-1566
TP6-6908-014

437X-1 Antenna (CPN 522-4140-001/006), Outline and Mounting Diagram Figure 2-11 (Sheet 2)


.218 .229 DIA, CSK 100° OPP SIDE TO
.390 .400 DIA, 8 HOLES SPACED AT 45° +1/-2 °
45°
6.250 ± .008 DIA
MARKING DOT
2.600 R MAX
.120 MAX FILLET 4 PLACES
7.010 6.990 DIA
.032 DIA HOLE THROUGH CONNECTOR MTG SCREWS FOR SAFETY WIRE TO MATING CONNECTOR
CONNECTOR TYPE TNC FEMALE
.250 ± .005
2.000 MIN
2.750 MAX
.145 ± .015

NOTES:

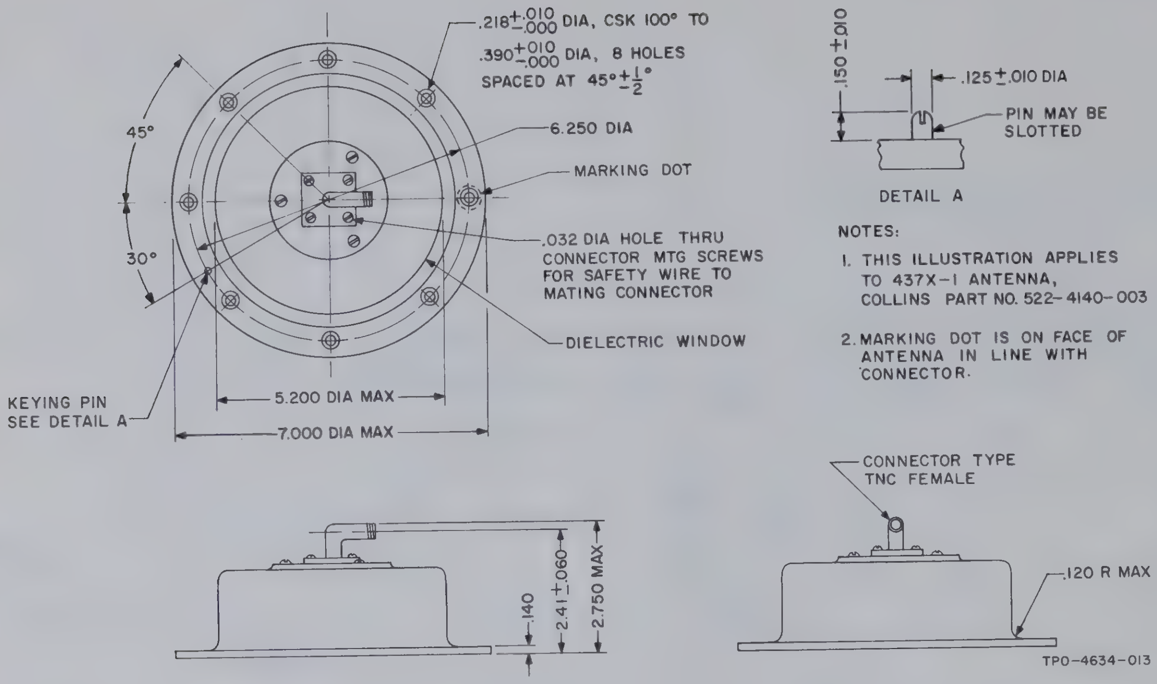
① THIS ILLUSTRATION APPLIES TO 437X-1 (-002 AND -004) ANTENNA, COLLINS PART NUMBERS 522-4140-002 AND 522-4140-004.

② MARKING DOT IS ON FACE OF ANTENNA IN LINE WITH CONNECTOR.

③ WEIGHT 1.0 POUND (NOMINAL).

768-1565-001

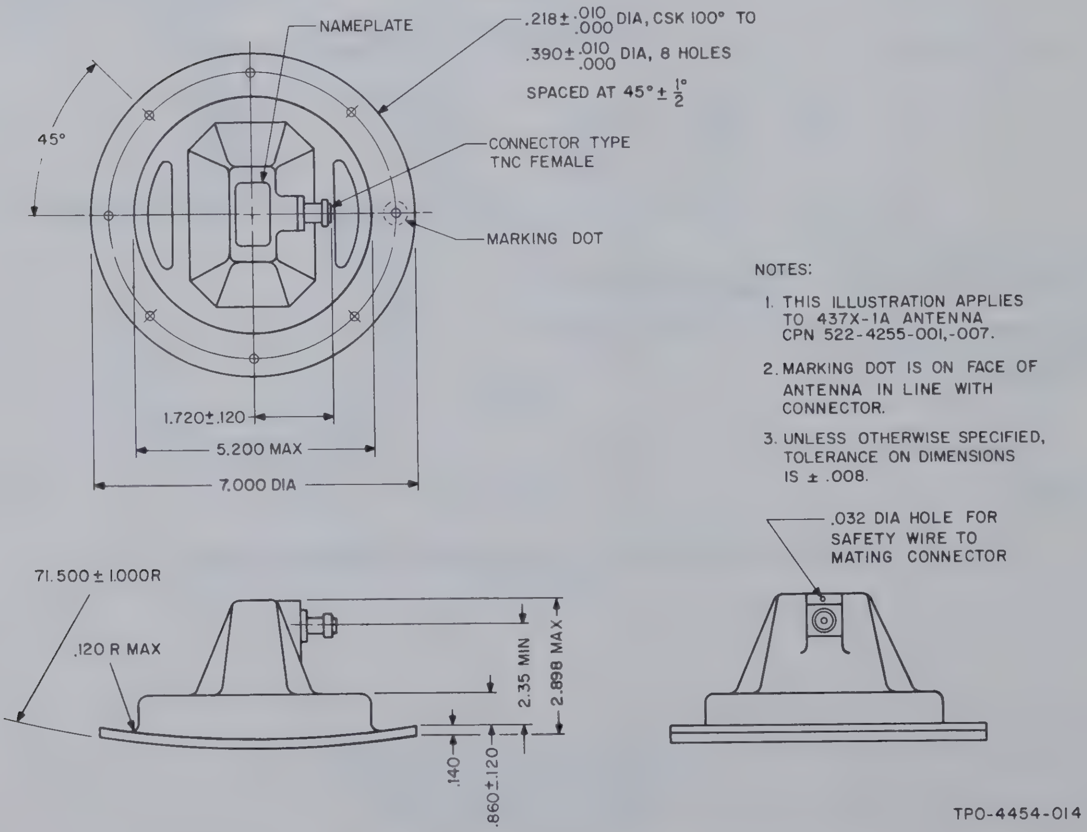
437X-1 Antenna (CPN 522-4140-002/004), Outline and Mounting Diagram
Figure 2-12


.218 +.010/−.000 DIA, CSK 100° TO
.390 +.010/−.000 DIA, 8 HOLES
SPACED AT 45° ± 1/2°
45°
30°
6.250 DIA
MARKING DOT
.032 DIA HOLE THRU
CONNECTOR MTG SCREWS
FOR SAFETY WIRE TO
MATING CONNECTOR
DIELECTRIC WINDOW
KEYING PIN
SEE DETAIL A
5.200 DIA MAX
7.000 DIA MAX
.150 ±.010
.125 ±.010 DIA
PIN MAY BE
SLOTTED
DETAIL A
CONNECTOR TYPE
TNC FEMALE
.120 R MAX
.140
2.41 ±.060
2.750 MAX
TPO-4634-013

NOTES:

1. THIS ILLUSTRATION APPLIES TO 437X-1 ANTENNA, COLLINS PART NO. 522-4140-003
2. MARKING DOT IS ON FACE OF ANTENNA IN LINE WITH CONNECTOR.

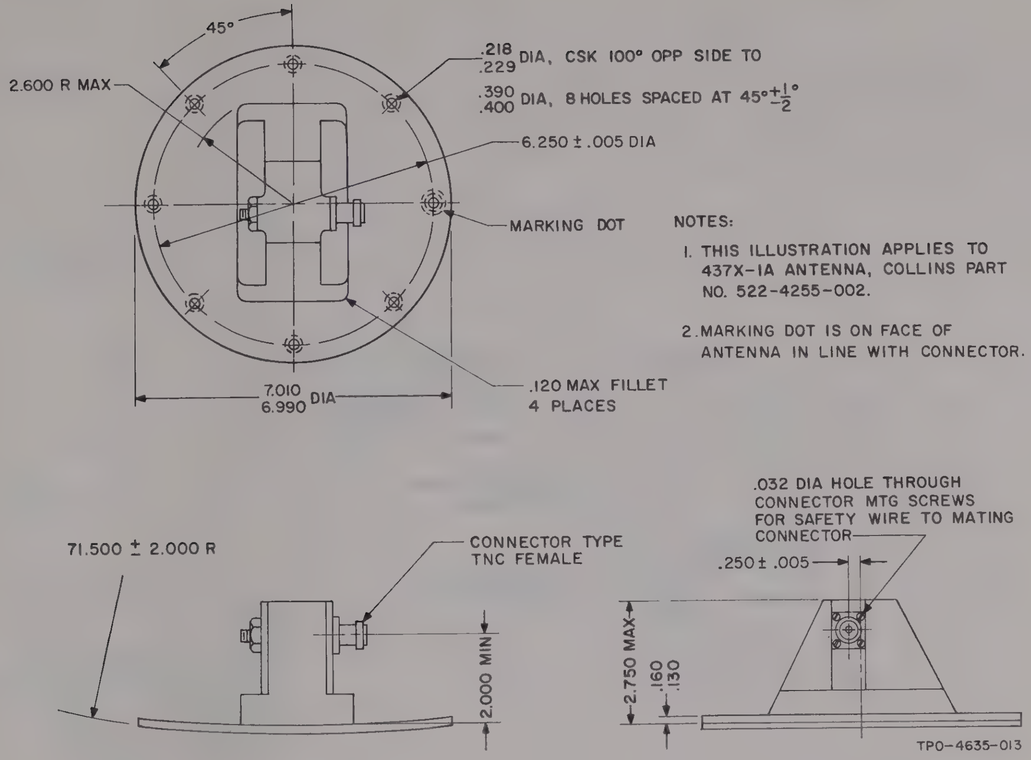
437X-1 Antenna (CPN 4140-003), Outline and Mounting Diagram
Figure 2-13


NAMEPLATE
.218 ± .010/.000 DIA, CSK 100° TO
.390 ± .010/.000 DIA, 8 HOLES
SPACED AT 45° ± 1/2°
45°
CONNECTOR TYPE
TNC FEMALE
MARKING DOT
1.720 ±.120
5.200 MAX
7.000 DIA
71.500 ± 1.000R
.120 R MAX
2.35 MIN
2.898 MAX
.140
.860 ±.120
.032 DIA HOLE FOR
SAFETY WIRE TO
MATING CONNECTOR
TPO-4454-014

NOTES:

1. THIS ILLUSTRATION APPLIES TO 437X-1A ANTENNA CPN 522-4255-001,-007.
2. MARKING DOT IS ON FACE OF ANTENNA IN LINE WITH CONNECTOR.
3. UNLESS OTHERWISE SPECIFIED, TOLERANCE ON DIMENSIONS IS ± .008.

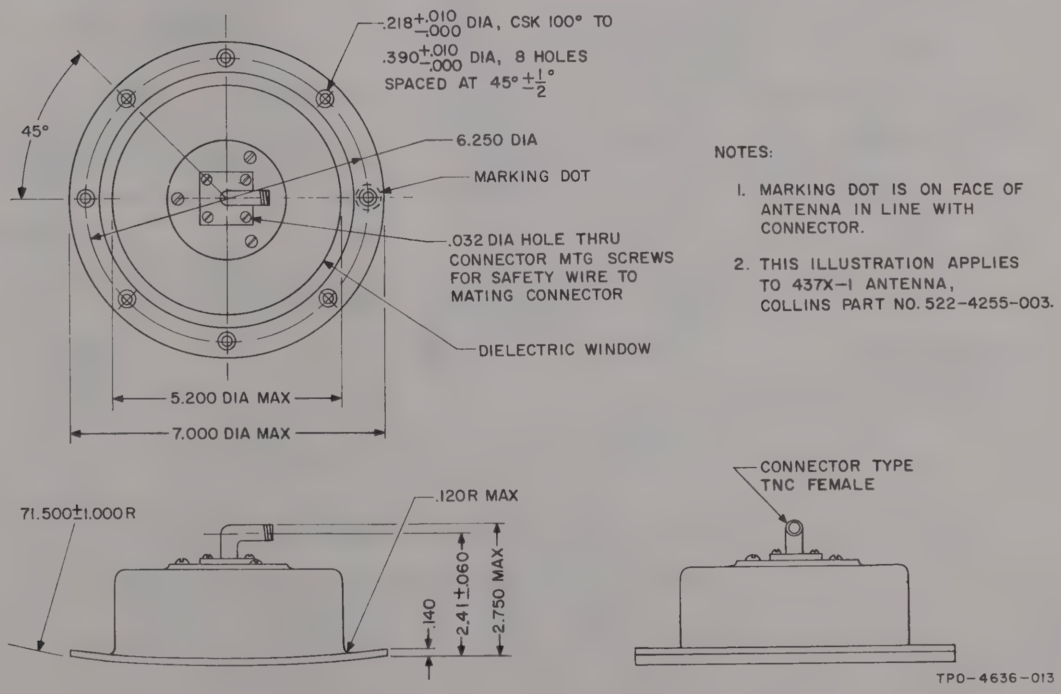
437X-1A Antenna (CPN 522-4255-001/007), Outline and Mounting Diagram
Figure 2-14


45°
2.600 R MAX
.218 .229 DIA, CSK 100° OPP SIDE TO
.390 .400 DIA, 8 HOLES SPACED AT 45° ± 1/2°
6.250 ± .005 DIA
MARKING DOT
.120 MAX FILLET 4 PLACES
7.010 6.990 DIA
71.500 ± 2.000 R
CONNECTOR TYPE TNC FEMALE
2.000 MIN
.032 DIA HOLE THROUGH CONNECTOR MTG SCREWS FOR SAFETY WIRE TO MATING CONNECTOR
.250 ± .005
2.750 MAX
.160 .130
TPO-4635-013

NOTES:

1. THIS ILLUSTRATION APPLIES TO 437X-1A ANTENNA, COLLINS PART NO. 522-4255-002.
2. MARKING DOT IS ON FACE OF ANTENNA IN LINE WITH CONNECTOR.

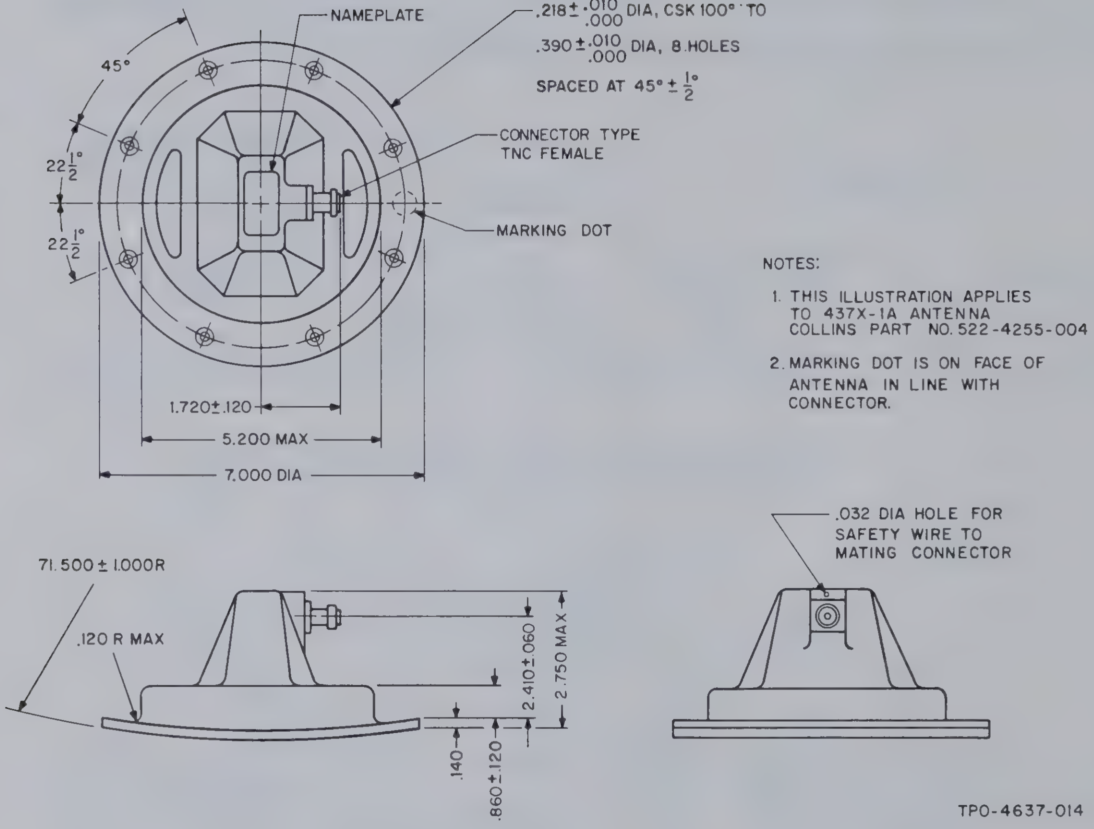
437X-1A Antenna (CPN 522-4255-002), Outline and Mounting Diagram
Figure 2-15


.218 +.010 -.000 DIA, CSK 100° TO
.390 +.010 -.000 DIA, 8 HOLES SPACED AT 45° ± 1/2°
45°
6.250 DIA
MARKING DOT
.032 DIA HOLE THRU CONNECTOR MTG SCREWS FOR SAFETY WIRE TO MATING CONNECTOR
DIELECTRIC WINDOW
5.200 DIA MAX
7.000 DIA MAX
71.500±1.000 R
.120R MAX
.140
2.41±.060
2.750 MAX
CONNECTOR TYPE TNC FEMALE
TPO-4636-013

NOTES:

1. MARKING DOT IS ON FACE OF ANTENNA IN LINE WITH CONNECTOR.
2. THIS ILLUSTRATION APPLIES TO 437X-1 ANTENNA, COLLINS PART NO. 522-4255-003.

437X-1A Antenna (CPN 522-4255-003), Outline and Mounting Diagram
Figure 2-16


NAMEPLATE
.218 ± .010/.000 DIA, CSK 100° TO
.390 ± .010/.000 DIA, 8 HOLES
SPACED AT 45° ± 1/2°
45°
22 1/2°
22 1/2°
CONNECTOR TYPE TNC FEMALE
MARKING DOT
1.720 ± .120
5.200 MAX
7.000 DIA
71.500 ± 1.000R
.120 R MAX
2.410 ± .060
2.750 MAX
.140
.860 ± .120
.032 DIA HOLE FOR SAFETY WIRE TO MATING CONNECTOR
TPO-4637-014

NOTES:

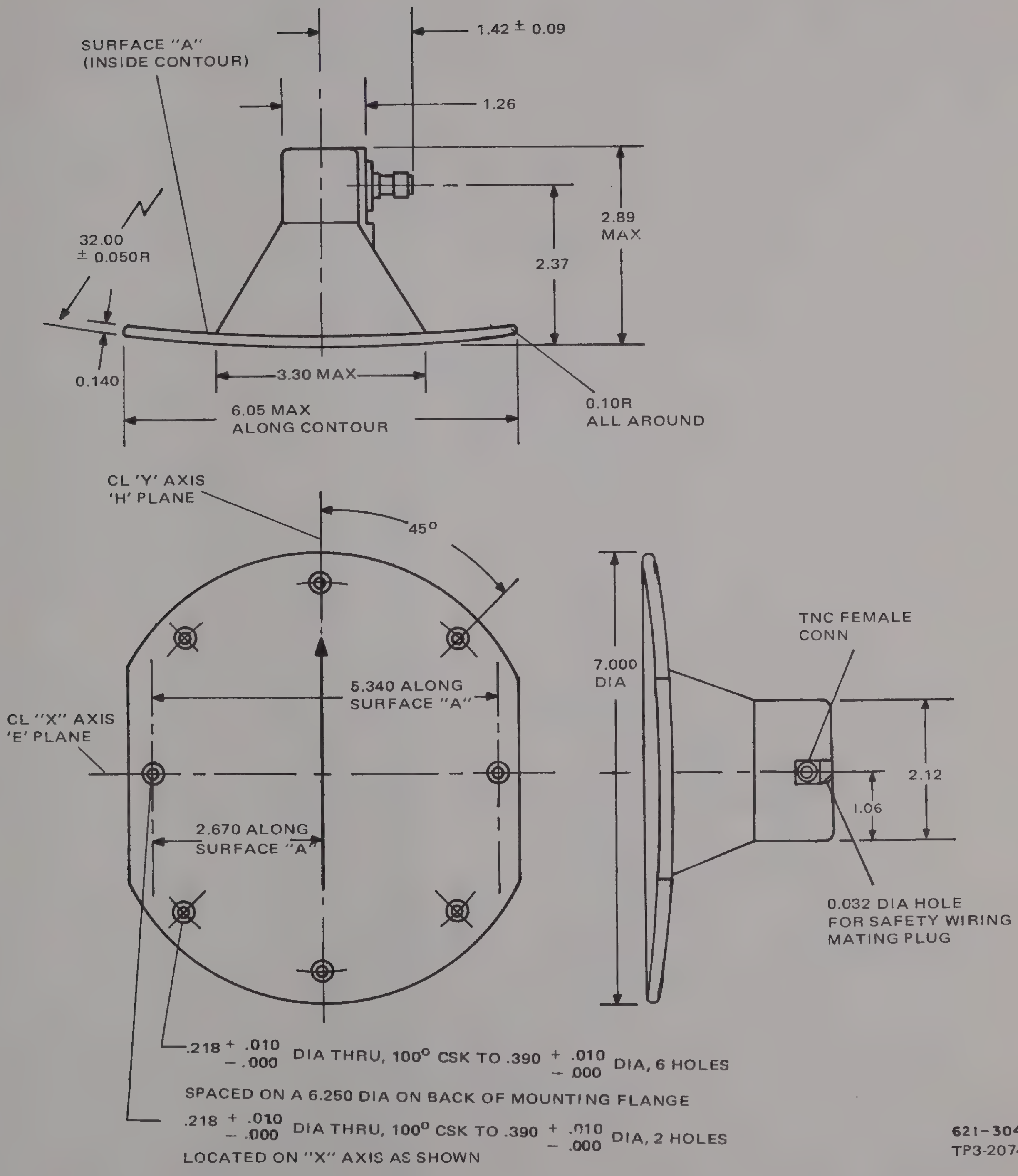
1. THIS ILLUSTRATION APPLIES TO 437X-1A ANTENNA COLLINS PART NO. 522-4255-004
2. MARKING DOT IS ON FACE OF ANTENNA IN LINE WITH CONNECTOR.

437X-1A Antenna (CPN 522-4255-004), Outline and Mounting Diagram
Figure 2-17

NOTES:

① THIS ILLUSTRATION APPLIES TO 437X-1B ANTENNA, COLLINS PART NO. 622-0954-001.

② WEIGHT: 1.0 POUND MAX.


SURFACE "A" (INSIDE CONTOUR)
1.42 ± 0.09
1.26
32.00 ± 0.050R
2.89 MAX
2.37
0.140
3.30 MAX
6.05 MAX ALONG CONTOUR
0.10R ALL AROUND
CL 'Y' AXIS 'H' PLANE
45°
5.340 ALONG SURFACE "A"
CL "X" AXIS 'E' PLANE
2.670 ALONG SURFACE "A"
7.000 DIA
TNC FEMALE CONN
2.12
1.06
0.032 DIA HOLE FOR SAFETY WIRING MATING PLUG

.218 + .010 − .000 DIA THRU, 100° CSK TO .390 + .010 − .000 DIA, 6 HOLES SPACED ON A 6.250 DIA ON BACK OF MOUNTING FLANGE

.218 + .010 − .000 DIA THRU, 100° CSK TO .390 + .010 − .000 DIA, 2 HOLES LOCATED ON "X" AXIS AS SHOWN

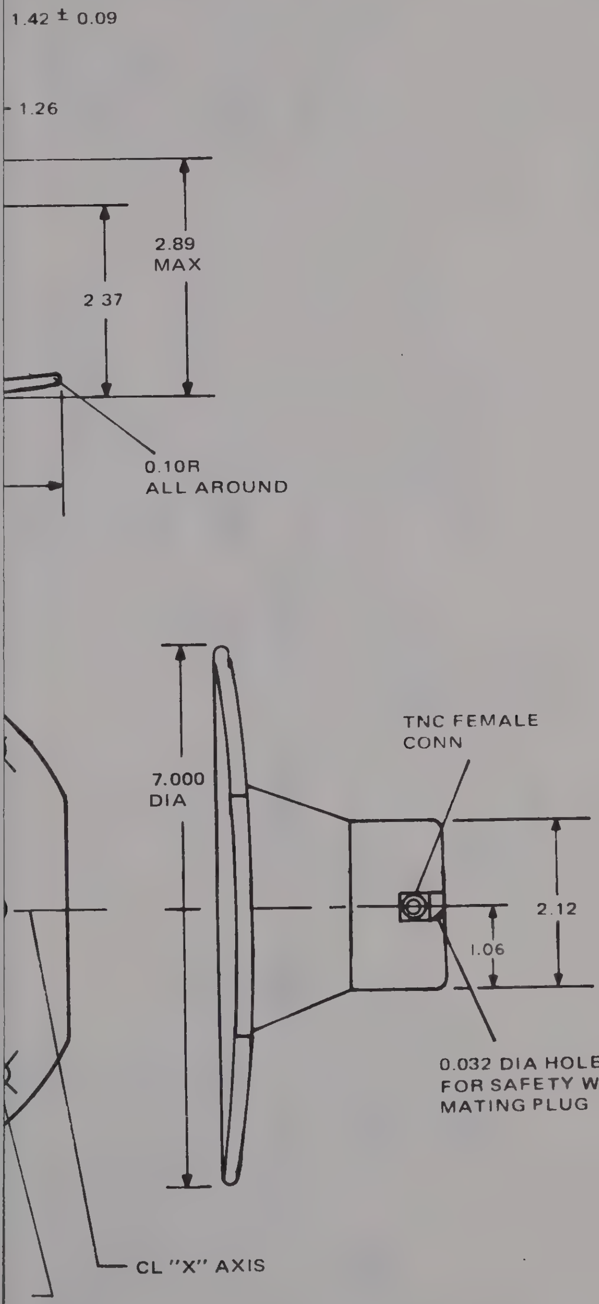
621-3043
TP3-2074-022

437X-1B Antenna (CPN 622-0954-001), Outline and Mounting Diagram
Figure 2-18

NOTES:

① THIS ILLUSTRATION APPLIES TO 437X 1B ANTENNA, COLLINS PART NO. 622 0954 002.

② WEIGHT: 1.0 POUND MAX.


1.42 ± 0.09
1.26
2.89
MAX
2 37
0.10R
ALL AROUND
7.000
DIA
TNC FEMALE
CONN
2.12
1.06
0.032 DIA HOLE
FOR SAFETY WIRING
MATING PLUG
CL "X" AXIS

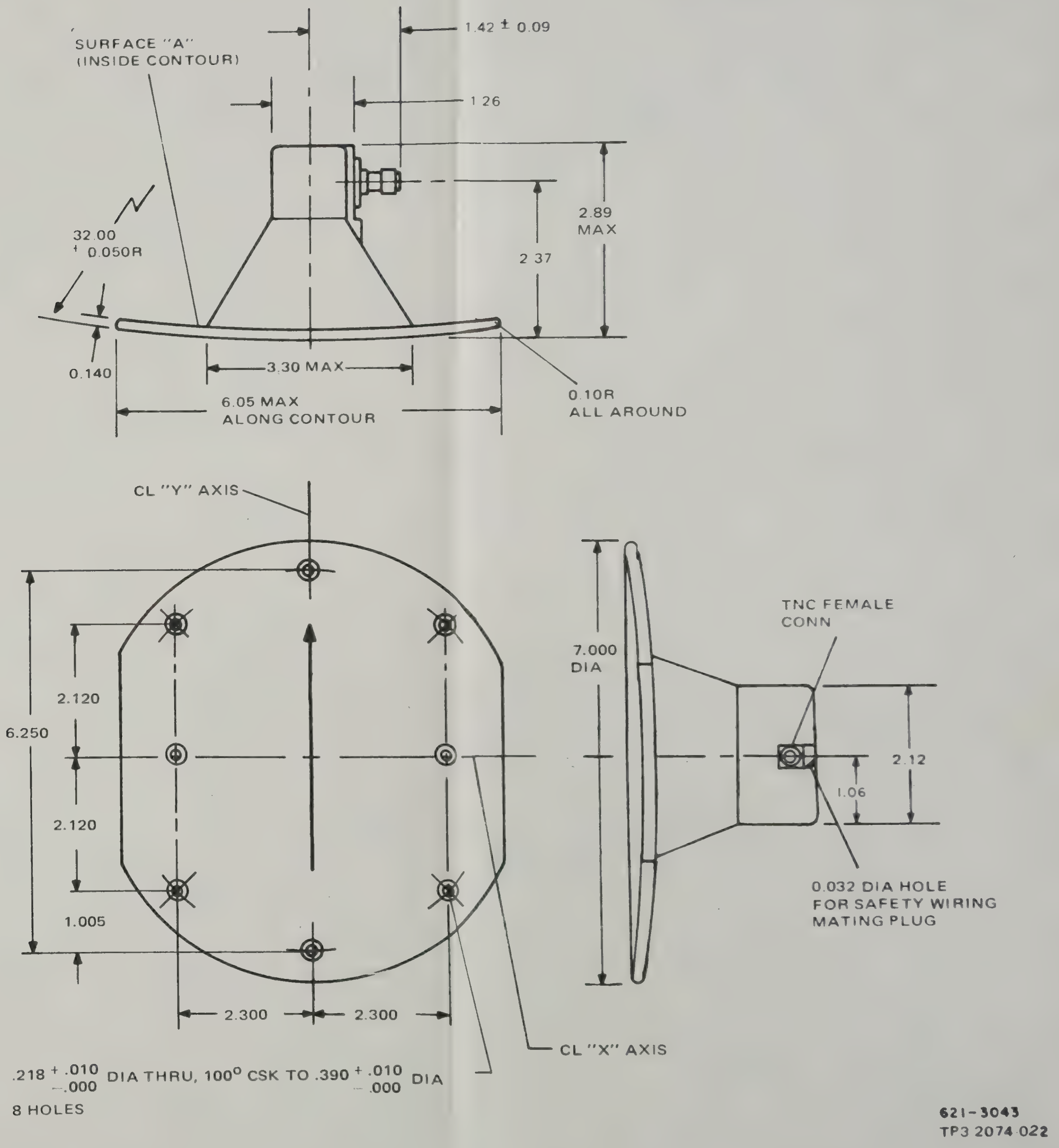
621-3043
TP3 2074 022

954-002), Outline and Mounting Diagram
Figure 2-19

NOTES

① THIS ILLUSTRATION APPLIES TO 437X 1B ANTENNA, COLLINS PART NO. 622 0954 002.

② WEIGHT: 1.0 POUND MAX


SURFACE "A" (INSIDE CONTOUR)
1.42 ± 0.09
1.26
32.00 ± 0.050R
2.89 MAX
2.37
0.140
3.30 MAX
6.05 MAX ALONG CONTOUR
0.10R ALL AROUND
CL "Y" AXIS
6.250
2.120
2.120
1.005
2.300
2.300
CL "X" AXIS
7.000 DIA
TNC FEMALE CONN
2.12
1.06
0.032 DIA HOLE FOR SAFETY WIRING MATING PLUG
.218 +.010 −.000 DIA THRU, 100° CSK TO .390 +.010 −.000 DIA
8 HOLES
621-3043
TP3 2074 022

437X-1B Antenna (CPN 622-0954-002), Outline and Mounting Diagram
Figure 2-19

RD AND .035 MAX BOW INWARD EXCLUSIVE OF MOUNTING

214/U COAXIAL CABLE, COLLINS PART NUMBER 357-7204-010.

PLIES TO COLLINS PART NUMBER 622-3698-001.

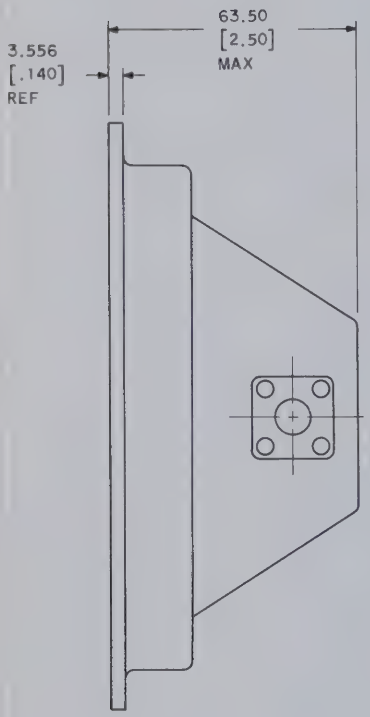
AMS [1.0 POUND] MAXIMUM.
IN MILLIMETRES [INCHES].

ECIFIED - TOLERANCES ON:
IN INCHES: XX=±.02, .XXX=±.008
INCHES: UNDER .251 DIA=+.005 -.005
.251 TO .500 DIA=±.006 -.005
OVER .500 DIA=+.008 -.005

METRIC DIMENSIONS IN MILLIMETRES: .X=±0.5, .XX=±0.2
HOLE DIAMETERS IN MILLIMETRES: UNDER 6.38 Ø=+0.13 -0.13
6.38 TO 12.7 Ø=+0.15 -0.13
OVER 12.7 Ø=+0.20 -0.13
ANGLES: ±1.0°

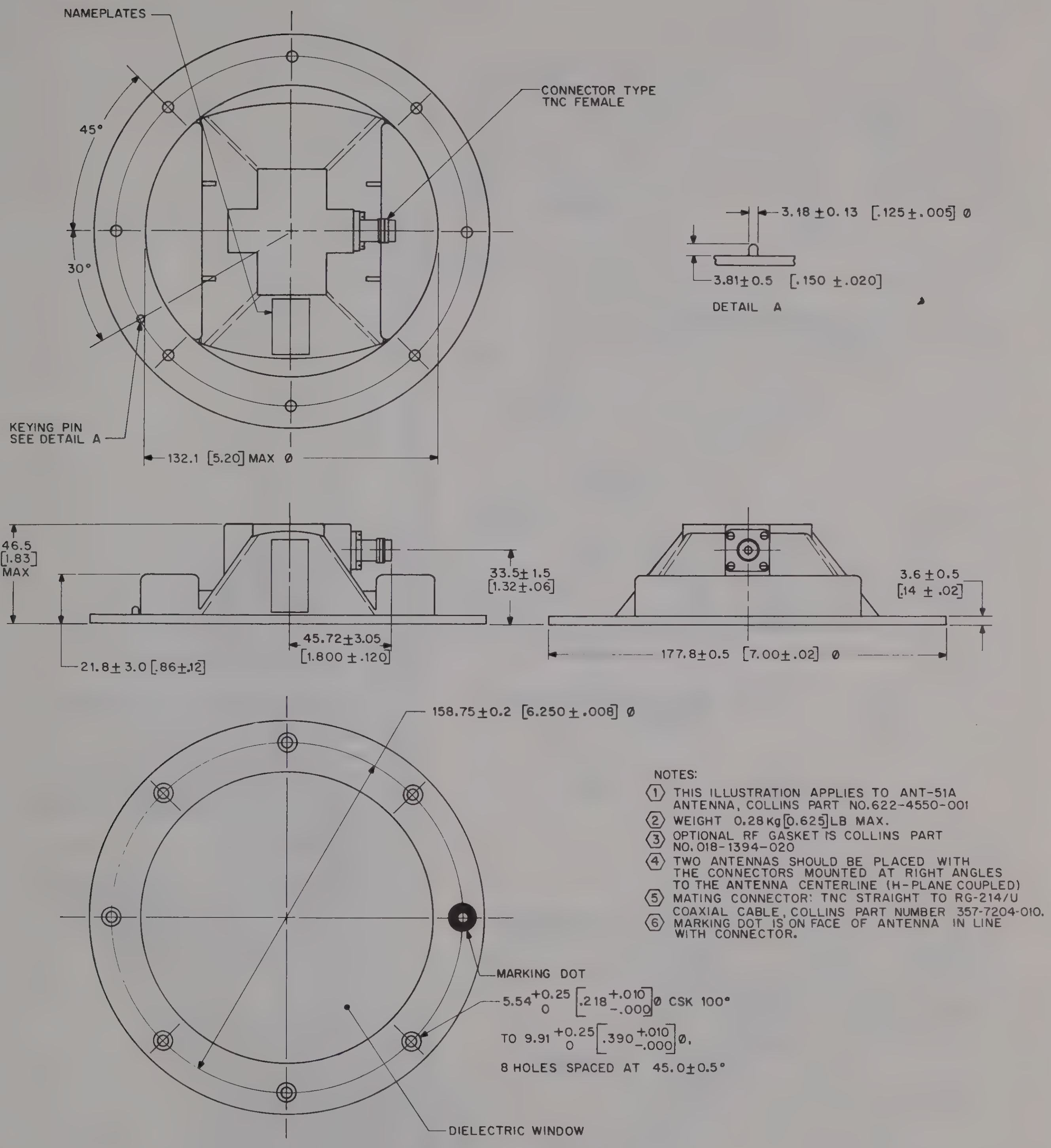
IS COLLINS PART NUMBER 018-1394-060.

D BE PLACED WITH THE CONNECTORS MOUNTED AT RIGHT ANGLES
TERLINE (H-PLANE COUPLED).



637-2218
TP4-9190-014

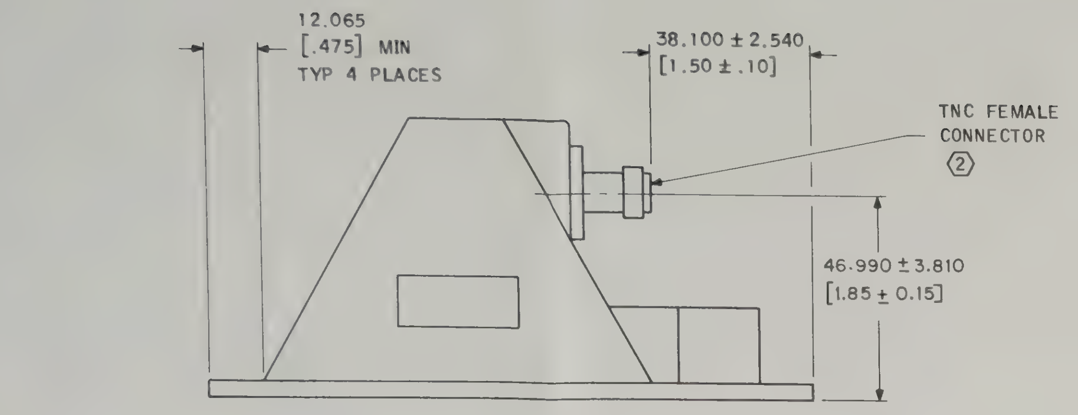
ANT-50A Antenna (CPN 622-3698-001),
Outline and Mounting Diagram
Figure 2-20


NAMEPLATES
CONNECTOR TYPE TNC FEMALE
45°
30°
KEYING PIN SEE DETAIL A
132.1 [5.20] MAX Ø
3.18 ± 0.13 [.125 ± .005] Ø
3.81 ± 0.5 [.150 ± .020]
DETAIL A
46.5 [1.83] MAX
33.5 ± 1.5 [1.32 ± .06]
45.72 ± 3.05 [1.800 ± .120]
21.8 ± 3.0 [.86 ± .12]
3.6 ± 0.5 [.14 ± .02]
177.8 ± 0.5 [7.00 ± .02] Ø
158.75 ± 0.2 [6.250 ± .008] Ø
MARKING DOT
5.54 +0.25/0 [.218 +.010/-.000] Ø CSK 100°
TO 9.91 +0.25/0 [.390 +.010/-.000] Ø,
8 HOLES SPACED AT 45.0 ± 0.5°
DIELECTRIC WINDOW

NOTES:
① THIS ILLUSTRATION APPLIES TO ANT-51A ANTENNA, COLLINS PART NO. 622-4550-001
② WEIGHT 0.28 Kg [0.625] LB MAX.
③ OPTIONAL RF GASKET IS COLLINS PART NO. 018-1394-020
④ TWO ANTENNAS SHOULD BE PLACED WITH THE CONNECTORS MOUNTED AT RIGHT ANGLES TO THE ANTENNA CENTERLINE (H-PLANE COUPLED)
⑤ MATING CONNECTOR: TNC STRAIGHT TO RG-214/U COAXIAL CABLE, COLLINS PART NUMBER 357-7204-010.
⑥ MARKING DOT IS ON FACE OF ANTENNA IN LINE WITH CONNECTOR.

641-1909

ANT-51A Antenna (CPN 622-4550-001), Outline and Mounting Diagram
Figure 2-21


12.065
[.475] MIN
TYP 4 PLACES
38.100 ± 2.540
[1.50 ± .10]
TNC FEMALE
CONNECTOR
②
46.990 ± 3.810
[1.85 ± 0.15]

NOTES:

① .020 MAX BOW OUTWARD AND .035 MAX BOW INWARD EXCLUSIVE OF MOUNTING FLANGE SURFACE.

② MATING CONNECTOR:
TNC STRAIGHT TO RG-214/U COAXIAL CABLE, COLLINS PART NUMBER 357-7204-010.

③ THIS ILLUSTRATION APPLIES TO COLLINS PART NUMBER 622-3698-001.

④ WEIGHT: .454 KILOGRAMS [1.0 POUND] MAXIMUM.

⑤ ALL DIMENSIONS ARE IN MILLIMETRES [INCHES].

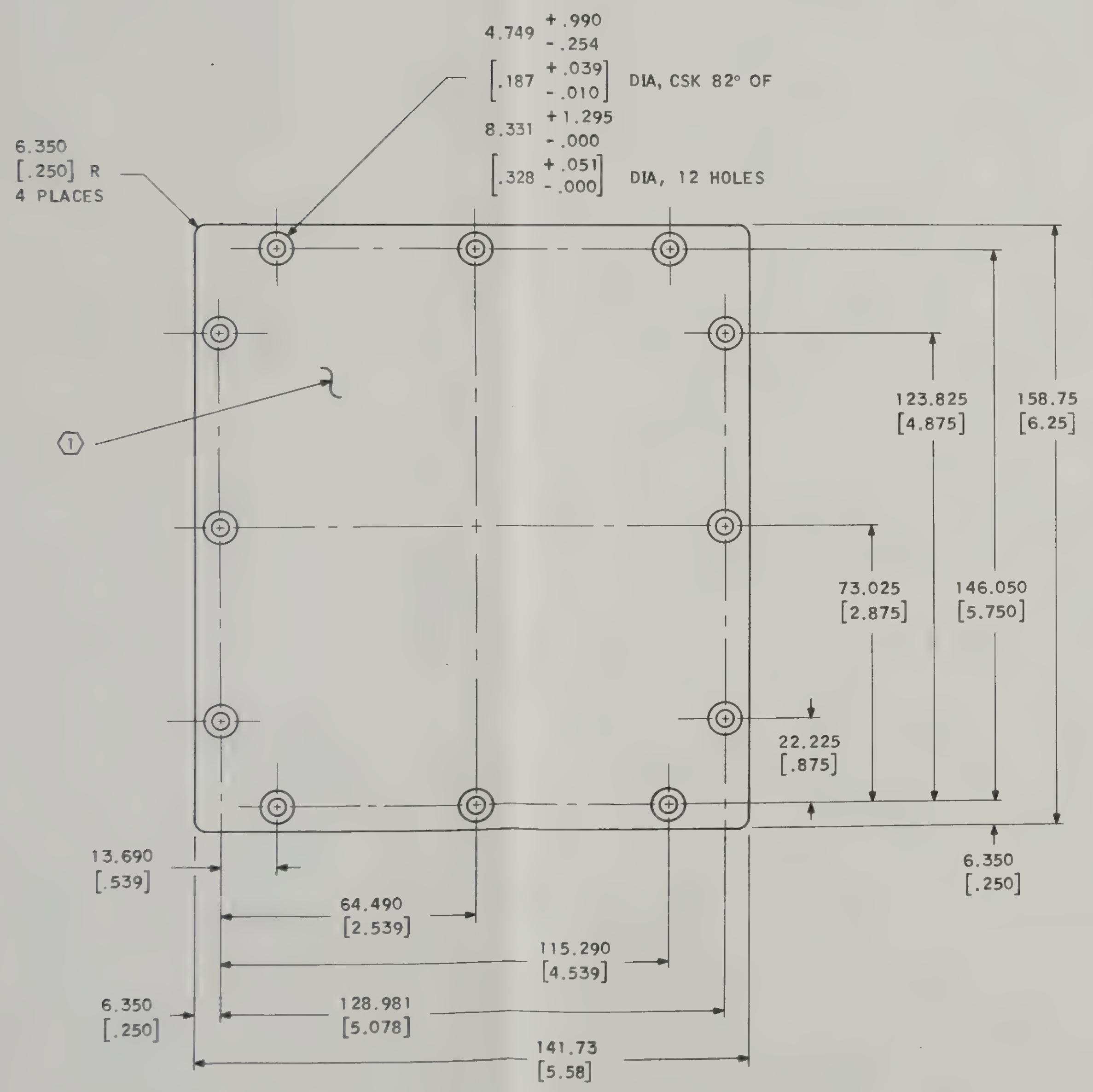
⑥ UNLESS OTHERWISE SPECIFIED - TOLERANCES ON:

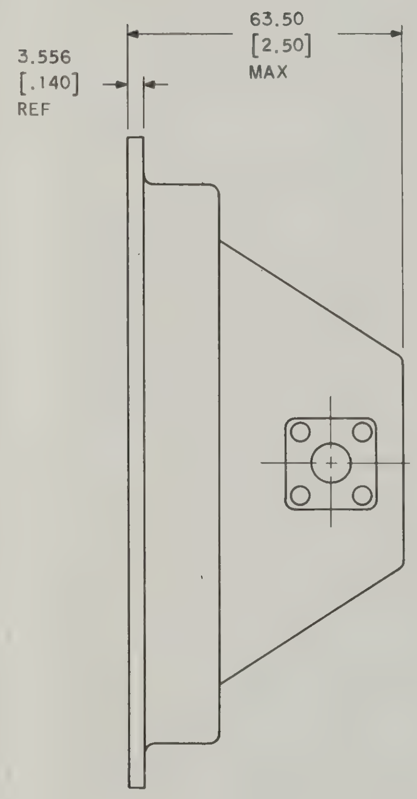
DECIMAL DIMENSION IN INCHES: XX=±.02, .XXX=±.008
HOLE DIAMETERS IN INCHES: UNDER .251 DIA=+.005 -.005
.251 TO .500 DIA=±.006 -.005
OVER .500 DIA=+.008 -.005
ANGLES: ±1.0°

METRIC DIMENSIONS IN MILLIMETRES: .X=±0.5, .XX=±0.2
HOLE DIAMETERS IN MILLIMETRES: UNDER 6.38 Ø=+0.13 -0.13
6.38 TO 12.7 Ø=+0.15 -0.13
OVER 12.7 Ø=+0.20 -0.13
ANGLES: ±1.0°

⑦ OPTIONAL RF GASKET IS COLLINS PART NUMBER 018-1394-060.

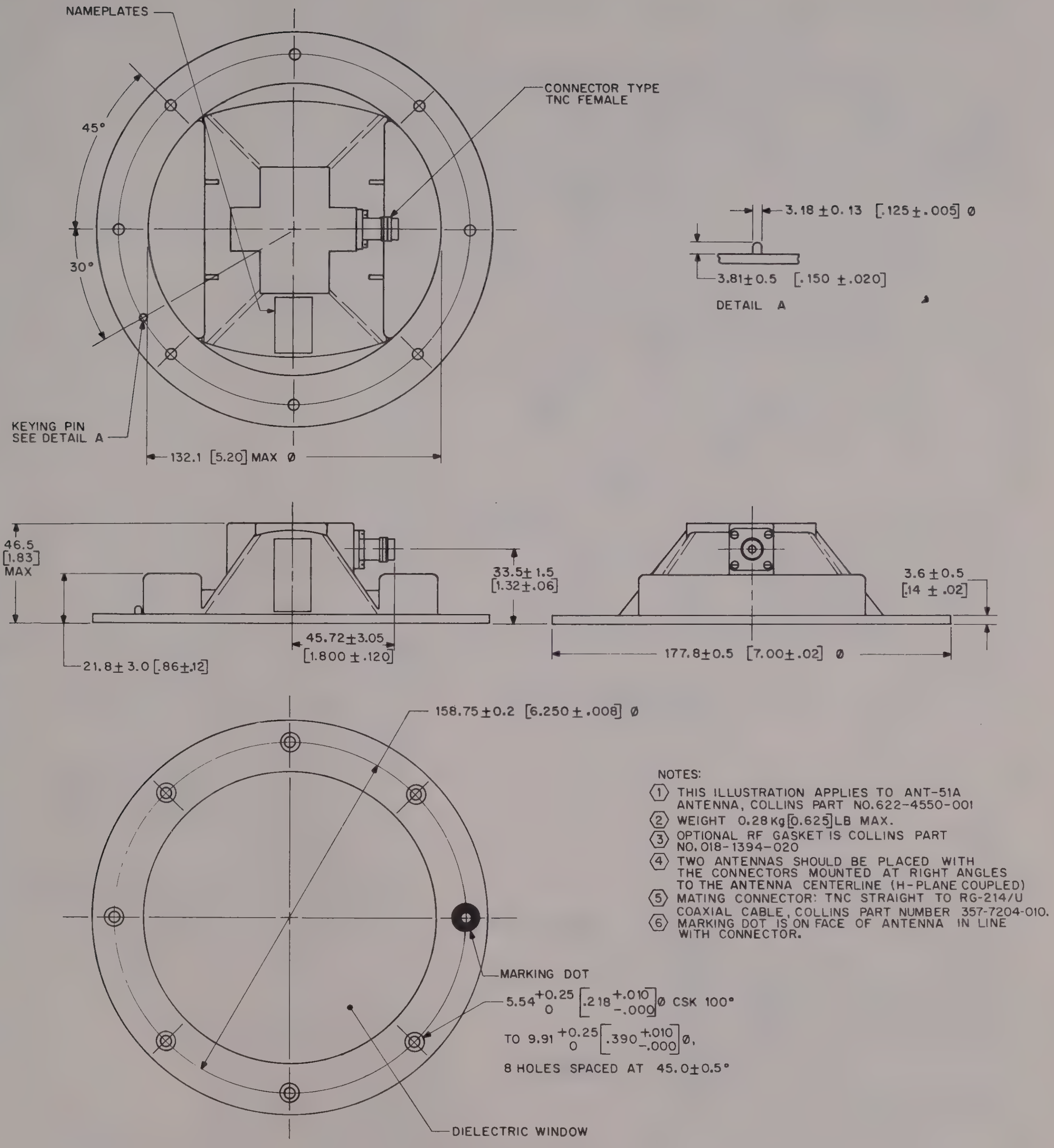
⑧ TWO ANTENNAS SHOULD BE PLACED WITH THE CONNECTORS MOUNTED AT RIGHT ANGLES TO THE ANTENNA CENTERLINE (H-PLANE COUPLED).


4.749 +.990 -.254
[.187 +.039 -.010] DIA, CSK 82° OF
8.331 +1.295 -.000
[.328 +.051 -.000] DIA, 12 HOLES
6.350
[.250] R
4 PLACES
①
123.825
[4.875]
158.75
[6.25]
73.025
[2.875]
146.050
[5.750]
22.225
[.875]
6.350
[.250]
13.690
[.539]
64.490
[2.539]
115.290
[4.539]
6.350
[.250]
128.981
[5.078]
141.73
[5.58]


3.556
[.140]
REF
63.50
[2.50]
MAX

637-2218
TP4-9190-014

ANT-50A Antenna (CPN 622-3698-001),
Outline and Mounting Diagram
Figure 2-20


NAMEPLATES
CONNECTOR TYPE TNC FEMALE
45°
30°
KEYING PIN SEE DETAIL A
132.1 [5.20] MAX Ø
3.18 ± 0.13 [.125 ± .005] Ø
3.81 ± 0.5 [.150 ± .020]
DETAIL A
46.5 [1.83] MAX
33.5 ± 1.5 [1.32 ± .06]
45.72 ± 3.05 [1.800 ± .120]
21.8 ± 3.0 [.86 ± .12]
3.6 ± 0.5 [.14 ± .02]
177.8 ± 0.5 [7.00 ± .02] Ø
158.75 ± 0.2 [6.250 ± .008] Ø
MARKING DOT
5.54 +0.25/0 [.218 +.010/−.000] Ø CSK 100°
TO 9.91 +0.25/0 [.390 +.010/−.000] Ø,
8 HOLES SPACED AT 45.0 ± 0.5°
DIELECTRIC WINDOW
641-1909

NOTES:

① THIS ILLUSTRATION APPLIES TO ANT-51A ANTENNA, COLLINS PART NO. 622-4550-001

② WEIGHT 0.28 Kg [0.625] LB MAX.

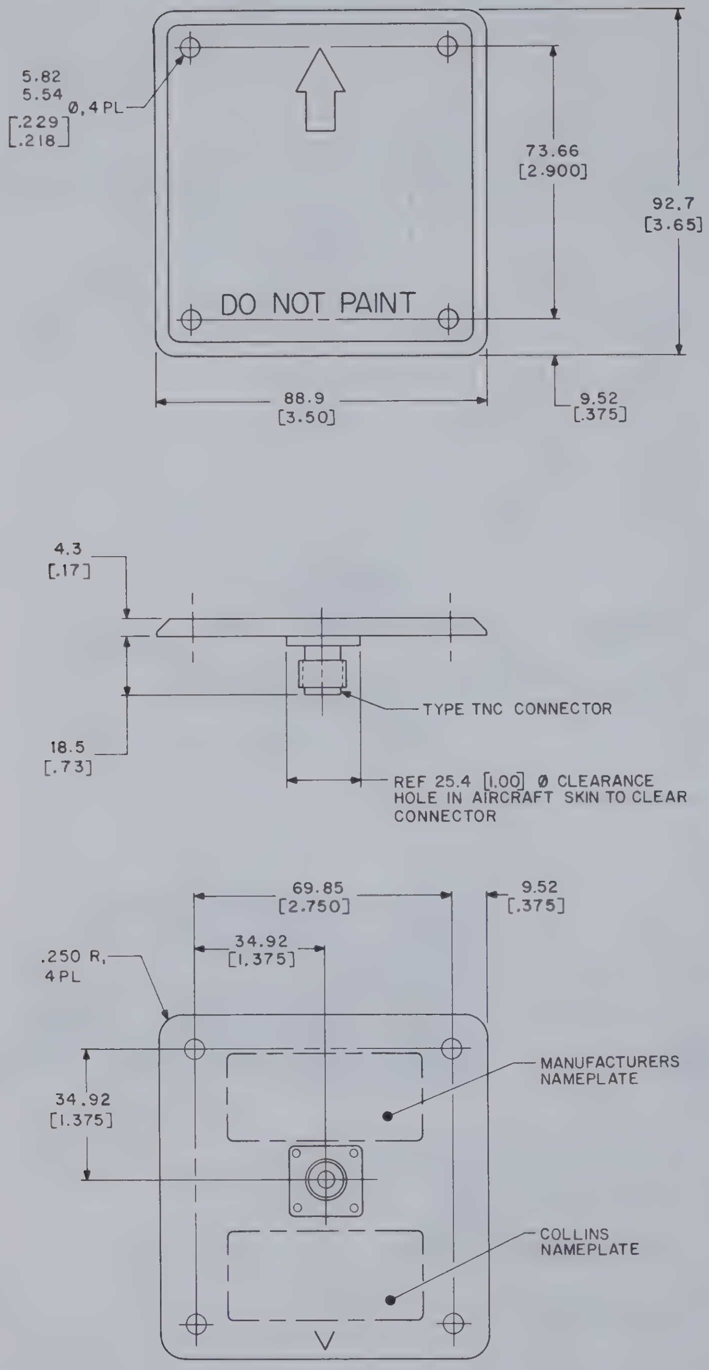
③ OPTIONAL RF GASKET IS COLLINS PART NO. 018-1394-020

④ TWO ANTENNAS SHOULD BE PLACED WITH THE CONNECTORS MOUNTED AT RIGHT ANGLES TO THE ANTENNA CENTERLINE (H-PLANE COUPLED)

⑤ MATING CONNECTOR: TNC STRAIGHT TO RG-214/U COAXIAL CABLE, COLLINS PART NUMBER 357-7204-010.

⑥ MARKING DOT IS ON FACE OF ANTENNA IN LINE WITH CONNECTOR.

ANT-51A Antenna (CPN 622-4550-001), Outline and Mounting Diagram
Figure 2-21


5.82
5.54
[.229
.218]
Ø, 4 PL
DO NOT PAINT
73.66
[2.900]
92.7
[3.65]
88.9
[3.50]
9.52
[.375]
4.3
[.17]
18.5
[.73]
TYPE TNC CONNECTOR
REF 25.4 [1.00] Ø CLEARANCE HOLE IN AIRCRAFT SKIN TO CLEAR CONNECTOR
69.85
[2.750]
9.52
[.375]
34.92
[1.375]
.250 R, 4 PL
34.92
[1.375]
MANUFACTURERS NAMEPLATE
COLLINS NAMEPLATE

NOTES:

① THIS DRAWING APPLIES TO ANT-52 ANTENNA, CPN 622-6793-001

② WEIGHT: 0.09 kg [.219 LBS] MAX.

③ OPTIONAL RF GASKET IS CPN 018-1394-100.

④ TWO ANTENNAS MUST BE MOUNTED WITH THE BLACK ARROWS IN LINE AND EITHER POINTING IN THE SAME DIRECTION OR DIRECTLY OPPOSED.

⑤ MATING CONNECTOR:
TNC STRAIGHT TO RG-214/U COAXIAL CABLE, CPN 357-7204-010.

⑥ ANTENNAS MUST BE MOUNTED USING BUTTONHEAD CAP SCREWS AS SUPPLIED WITH THE ANTENNA. IF THESE SCREWS ARE INCORRECT OR MISSING, USE CPN 324-1671-550 ONLY.

⑦ AIRCRAFT FUSELAGE MUST BE FREE OF PAINT IN THE AREA UNDER EACH ANTENNA.

652-8059

ANT-52 Antenna (CPN 622-6793-001), Outline and Mounting Diagram
Figure 2-22

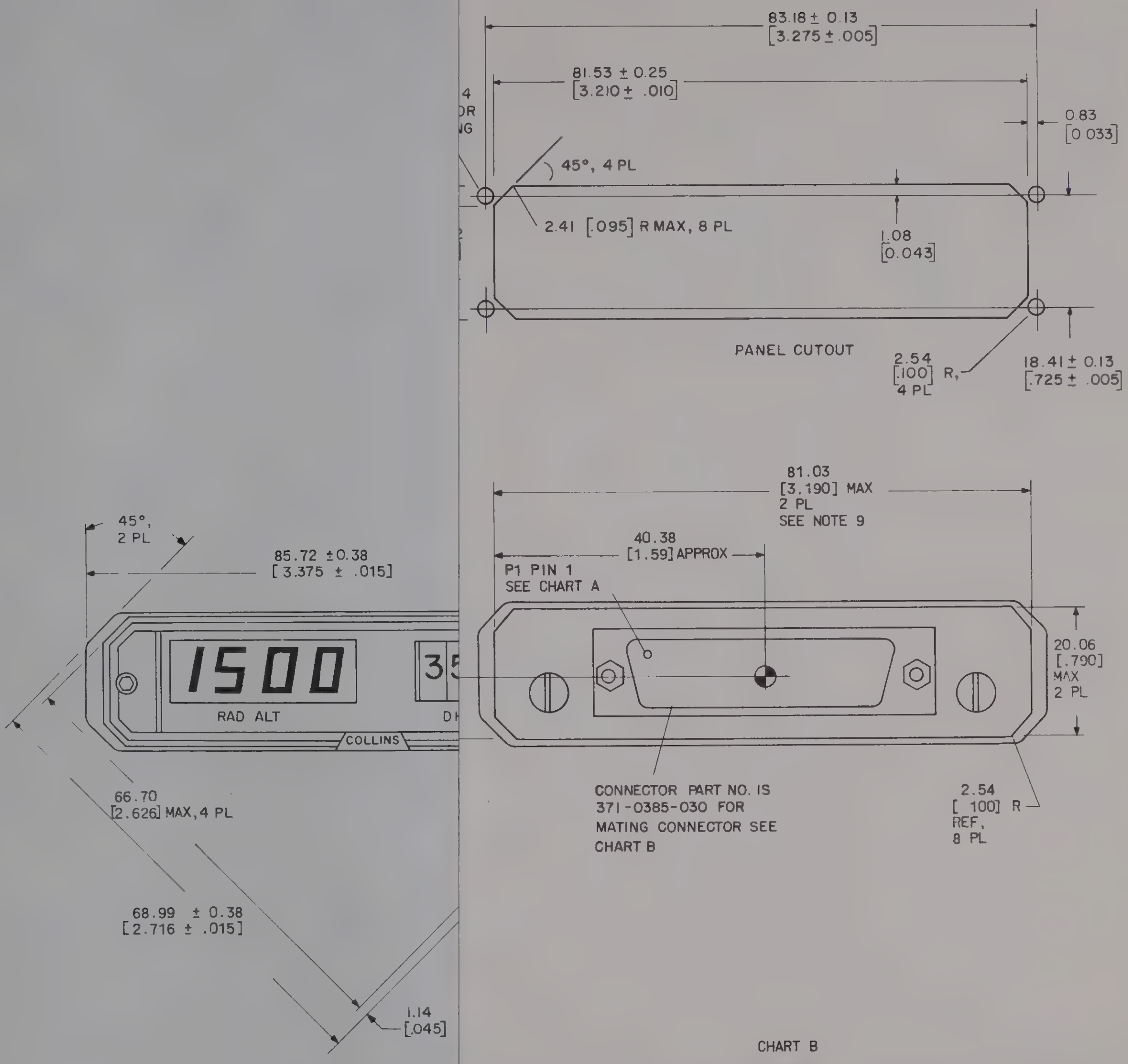

83.18 ± 0.13
[3.275 ± .005]
81.53 ± 0.25
[3.210 ± .010]
4
OR
NG
0.83
[0.033]
45°, 4 PL
2.41 [.095] R MAX, 8 PL
1.08
[0.043]
PANEL CUTOUT
2.54
[.100] R,
4 PL
18.41 ± 0.13
[.725 ± .005]
81.03
[3.190] MAX
2 PL
SEE NOTE 9
40.38
[1.59] APPROX
P1 PIN 1
SEE CHART A
45°,
2 PL
85.72 ±0.38
[3.375 ± .015]
1500
RAD ALT
35
DH
COLLINS
20.06
[.790]
MAX
2 PL
CONNECTOR PART NO. IS
371-0385-030 FOR
MATING CONNECTOR SEE
CHART B
2.54
[.100] R
REF,
8 PL
66.70
[2.626] MAX, 4 PL
68.99 ± 0.38
[2.716 ± .015]
1.14
[.045]

CHART B

MATING CONNECTOR	COLLINS PART NO.	ITT CANNON PART NO.
CONNECTOR BLOCK AND	371-0922-030	DBC-25S-FO
CRIMP CONTACTS	371-0946-060	D110238-35
OR		
CONNECTOR BLOCK WITH SOLDER CONTACTS INSTALLED	371-0221-000	DBM-25S

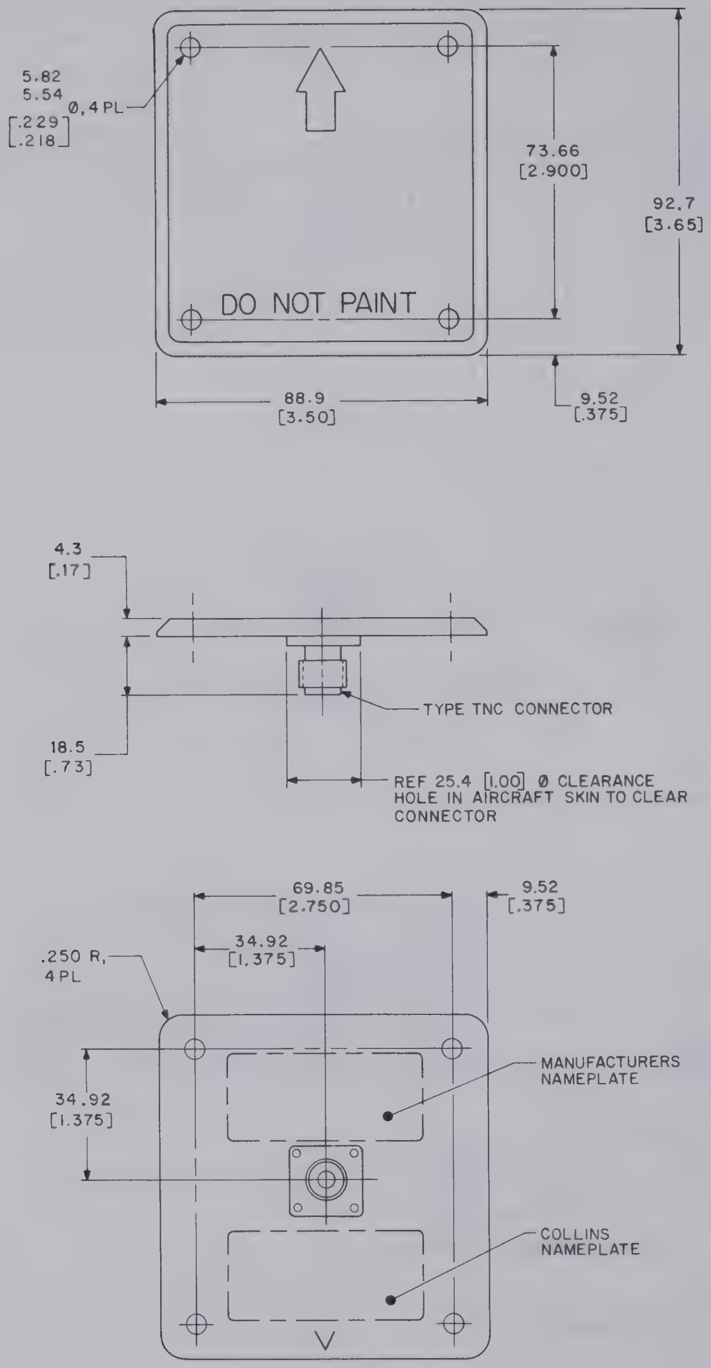
NOTES:

1. DIMENSIONS ARE IN MILLIMETRES [INCH
2. WEIGHT, 0.32 KILOGRAM [.7 POUND] AR
3. UNIT MAY BE MOUNTED USING ONE OF TH METHODS:
   - A. FRONT MOUNT USING INTEGRAL TURN 1.27 [.050] TO 3.18 [.125] THK. CLEARANCE REQUIREMENT ON REAR THIS METHOD USES A MINIMUM OF
   - B. FRONT MOUNT USING ADAPTER PLAT 629-8671-002, BLACK). NOTE IN HEIGHT WHEN USING ADAPTER PLA
   - C. REAR MOUNT USING MOORING PLATE NOTE INCREASE IN WIDTH AND HEI PLATE
4. THIS DRAWING IS APPLICABLE TO DRI-
5. ⊕ DENOTES CENTER OF GRAVITY

GND (-)
T
BLE
AG-
GND
REF
IS GND
G ALT (-)
G ALT (+)
NTIOMETER WIPER
POWER IN (+)

629-8894
TP5 3835-014

DRI-55 Digital Radio Altitude Indicator, Outline and Mounting Diagram
Figure 2-23


5.82
5.54
Ø.4 PL
[.229
.218]
73.66
[2.900]
92.7
[3.65]
DO NOT PAINT
88.9
[3.50]
9.52
[.375]
4.3
[.17]
18.5
[.73]
TYPE TNC CONNECTOR
REF 25.4 [1.00] Ø CLEARANCE HOLE IN AIRCRAFT SKIN TO CLEAR CONNECTOR
69.85
[2.750]
9.52
[.375]
34.92
[1.375]
.250 R,
4 PL
34.92
[1.375]
MANUFACTURERS NAMEPLATE
COLLINS NAMEPLATE

NOTES:

① THIS DRAWING APPLIES TO ANT-52 ANTENNA, CPN 622-6793-001

② WEIGHT: 0.09 kg [.219 LBS] MAX.

③ OPTIONAL RF GASKET IS CPN 018-1394-100.

④ TWO ANTENNAS MUST BE MOUNTED WITH THE BLACK ARROWS IN LINE AND EITHER POINTING IN THE SAME DIRECTION OR DIRECTLY OPPOSED.

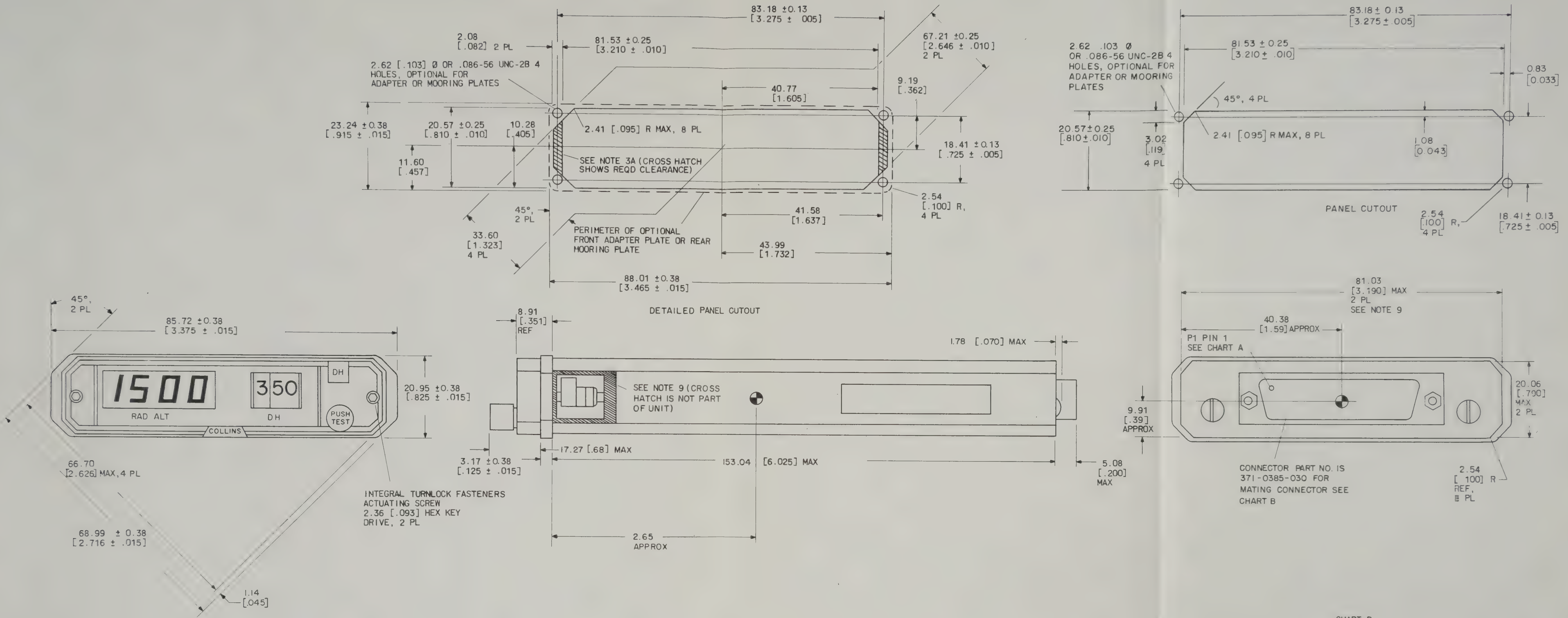
⑤ MATING CONNECTOR:
TNC STRAIGHT TO RG-214/U COAXIAL CABLE, CPN 357-7204-010.

⑥ ANTENNAS MUST BE MOUNTED USING BUTTONHEAD CAP SCREWS AS SUPPLIED WITH THE ANTENNA. IF THESE SCREWS ARE INCORRECT OR MISSING, USE CPN 324-1671-550 ONLY.

⑦ AIRCRAFT FUSELAGE MUST BE FREE OF PAINT IN THE AREA UNDER EACH ANTENNA.

652-8059

ANT-52 Antenna (CPN 622-6793-001), Outline and Mounting Diagram
Figure 2-22


83.18 ±0.13 [3.275 ± 005]
2.08 [.082] 2 PL
81.53 ±0.25 [3.210 ± .010]
2.62 [.103] Ø OR .086-56 UNC-2B 4 HOLES, OPTIONAL FOR ADAPTER OR MOORING PLATES
67.21 ±0.25 [2.646 ± .010] 2 PL
40.77 [1.605]
9.19 [.362]
23.24 ±0.38 [.915 ± .015]
20.57 ±0.25 [.810 ± .010]
10.28 [.405]
11.60 [.457]
2.41 [.095] R MAX, 8 PL
SEE NOTE 3A (CROSS HATCH SHOWS REQD CLEARANCE)
18.41 ±0.13 [.725 ± .005]
2.54 [.100] R, 4 PL
45°, 2 PL
33.60 [1.323] 4 PL
PERIMETER OF OPTIONAL FRONT ADAPTER PLATE OR REAR MOORING PLATE
41.58 [1.637]
43.99 [1.732]
88.01 ±0.38 [3.465 ± .015]
DETAILED PANEL CUTOUT
83.18 ± 0.13 [3.275 ± .005]
2.62 .103 Ø OR .086-56 UNC-2B 4 HOLES, OPTIONAL FOR ADAPTER OR MOORING PLATES
81.53 ± 0.25 [3.210 ± .010]
0.83 [0.033]
45°, 4 PL
20.57±0.25 [.810±.010]
3.02 [.119] 4 PL
2.41 [.095] R MAX, 8 PL
1.08 [0.043]
PANEL CUTOUT
2.54 [.100] R, 4 PL
18.41 ± 0.13 [.725 ± .005]
45°, 2 PL
85.72 ±0.38 [3.375 ± .015]
1500
RAD ALT
350
DH
DH
PUSH TEST
COLLINS
20.95 ±0.38 [.825 ± .015]
66.70 [2.626] MAX, 4 PL
68.99 ± 0.38 [2.716 ± .015]
1.14 [.045]
INTEGRAL TURNLOCK FASTENERS ACTUATING SCREW 2.36 [.093] HEX KEY DRIVE, 2 PL
8.91 [.351] REF
SEE NOTE 9 (CROSS HATCH IS NOT PART OF UNIT)
1.78 [.070] MAX
3.17 ±0.38 [.125 ± .015]
17.27 [.68] MAX
153.04 [6.025] MAX
5.08 [.200] MAX
9.91 [.39] APPROX
2.65 APPROX
81.03 [3.190] MAX 2 PL SEE NOTE 9
40.38 [1.59] APPROX
P1 PIN 1 SEE CHART A
20.06 [.790] MAX 2 PL
CONNECTOR PART NO. IS 371-0385-030 FOR MATING CONNECTOR SEE CHART B
2.54 [100] R REF, 8 PL

NOTES:

1 DIMENSIONS ARE IN MILLIMETRES [INCHES].

2. WEIGHT, 0.32 KILOGRAM [.7 POUND] APPROX.

3 UNIT MAY BE MOUNTED USING ONE OF THE FOLLOWING METHODS:

A. FRONT MOUNT USING INTEGRAL TURNLOCK FASTENERS 1 27 [.050] TO 3 18 [125] THK. OBSERVE CROSSHATCHED CLEARANCE REQUIREMENT ON REAR SURFACE OF PANEL. THIS METHOD USES A MINIMUM OF SPACE.

B. FRONT MOUNT USING ADAPTER PLATE (CPN 629-8671-001, GRAY; 629-8671-002, BLACK). NOTE INCREASE IN WIDTH AND HEIGHT WHEN USING ADAPTER PLATE.

C. REAR MOUNT USING MOORING PLATE (CPN 629-8672-001), NOTE INCREASE IN WIDTH AND HEIGHT WHEN USING MOORING PLATE

4. THIS DRAWING IS APPLICABLE TO DRI-55 (CPN 622-4160-XXX).

5. ● DENOTES CENTER OF GRAVITY

6. POLARIZATION ASSIGNMENT; PINS P1-1 AND P1-13 HAVE BEEN REMOVED. MATCHING POLARIZATION IS ACCOMPLISHED BY INSTALLER INSERTING KEY PLUG FOR KEYING (CPN-629-8339-001) INTO THE CORRESPONDING MATING SOCKET CONTACTS. KEY KITS (CPN 629-8381-001), 2 KEYS PER KIT, MUST BE SEPARATELY ORDERED.

7. THE REAR CONNECTOR (P1) IS FITTED WITH FEMALE SCREW LOCK POSTS MATING SCREW LOCK ASSY IS CPN 371-0040-010 (ITT CANNON D 20419-16), 2 REQUIRED. ENSURE THAT CABLE B IS LONG ENOUGH TO ALLOW CONNECTOR LOCKING SCREWS TO BE LOOSENED OR TIGHTENED.

8 MATING CONNECTOR CABLE CLAMP IS CPN 371-0185-000 (ITT CANNON DB20962)

9 WIDTH OF UNIT IMMEDIATELY BEHIND FLANGE (SHOWN CROSSHATCHED) IS 81.23 [3.198] MAX

10. MAXIMUM VIEWING ANGLE FROM A NORMAL TO FRONT FACE IS ± 35° IN VERTICAL DIRECTION AND ± 40° IN LATERAL DIRECTION.

CHART A

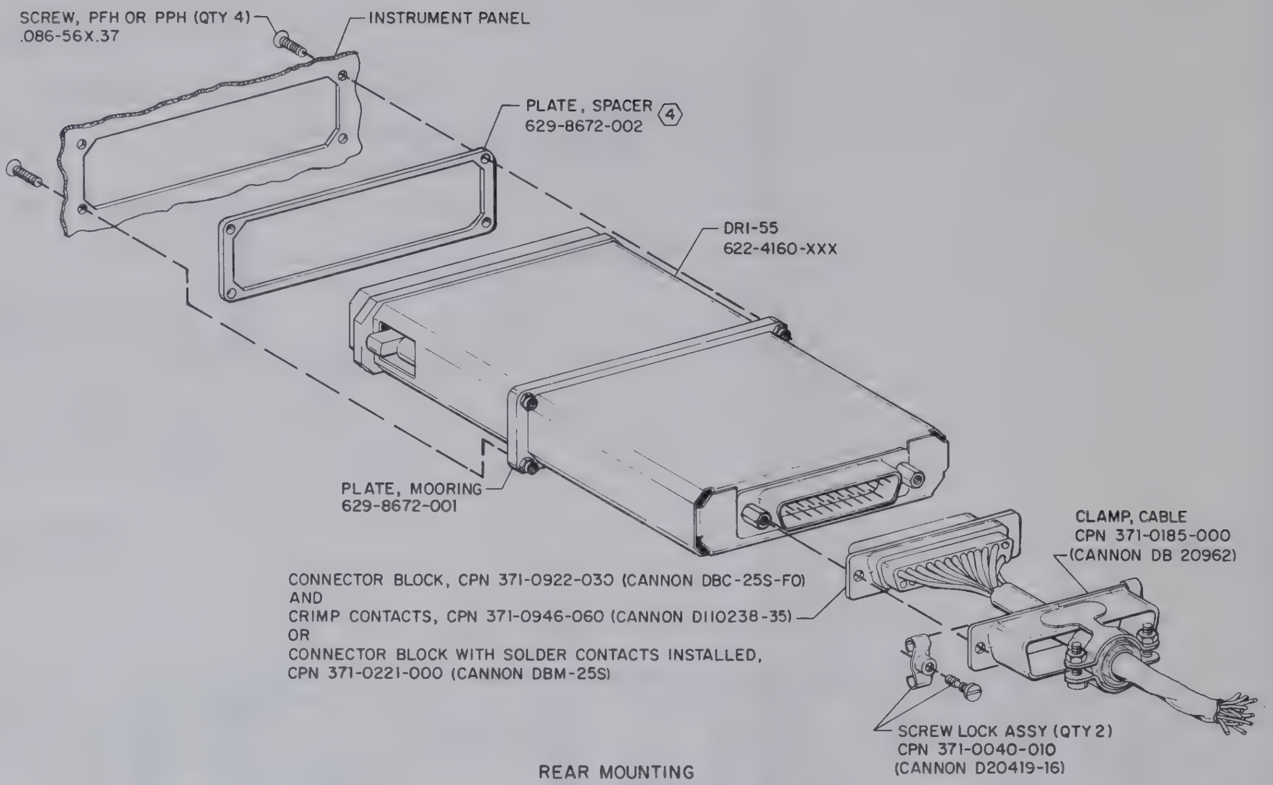
PIN FUNCTIONS			
1	KEYING	14	+28 V DC GND (-)
2	EXTERNAL DH	15	DH LAMP
3	EXTERNAL DH	16	SELF-TEST
4	28 V INST LTG (+)	17	TEST ENABLE
5	5 V DC INST LTG (+)	18	INST FLAG-
6	INST LTG (-)	19	DC PWR GND
7	DIM POTENTIOMETER LOW	20	+22 V DC REF
8	DIM POTENTIOMETER HIGH	21	DC CHASSIS GND
9	ARINC PGM (GROUND IF ARINC)	22	DC ANALOG ALT (-)
10	ALT 50/55 PGM (GROUND IF ALT 55)	23	DC ANALOG ALT (+)
11	SERIAL WORD	24	DIM POTENTIOMETER WIPER
12	SERIAL WORD (622-4160-00X ONLY)	25	+28 V DC POWER IN (+)
12	DH PROG EFF SB 6		
13	KEYING		

CHART B

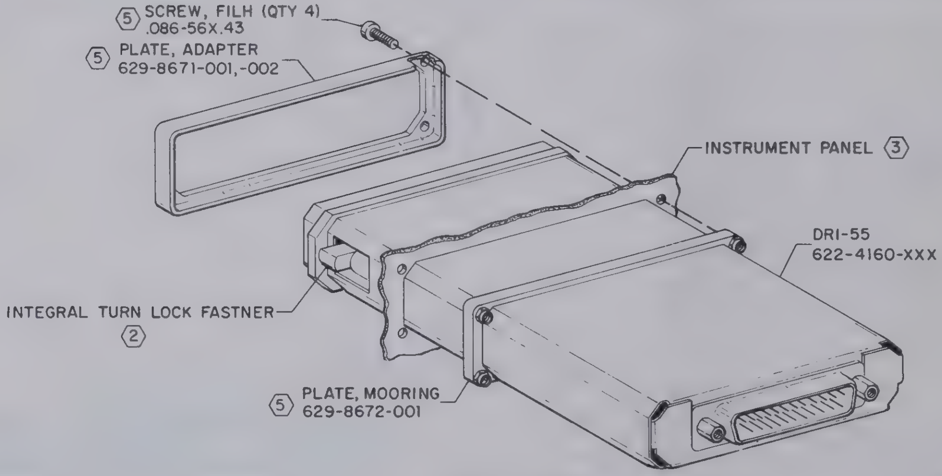
MATING CONNECTOR	COLLINS PART NO.	ITT CANNON PART NO.
CONNECTOR BLOCK AND	371-0922-030	DBC-25S-F0
CRIMP CONTACTS OR	371-0946-060	D110238-35
CONNECTOR BLOCK WITH SOLDER CONTACTS INSTALLED	371-0221-000	DBM-25S

629-8894
TP5 3835-014

DRI-55 Digital Radio Altitude Indicator, Outline and Mounting Diagram
Figure 2-23


SCREW, PFH OR PPH (QTY 4)
.086-56X.37
INSTRUMENT PANEL
PLATE, SPACER ④
629-8672-002
DRI-55
622-4160-XXX
PLATE, MOORING
629-8672-001
CLAMP, CABLE
CPN 371-0185-000
(CANNON DB 20962)
CONNECTOR BLOCK, CPN 371-0922-030 (CANNON DBC-25S-F0)
AND
CRIMP CONTACTS, CPN 371-0946-060 (CANNON D110238-35)
OR
CONNECTOR BLOCK WITH SOLDER CONTACTS INSTALLED,
CPN 371-0221-000 (CANNON DBM-25S)
SCREW LOCK ASSY (QTY 2)
CPN 371-0040-010
(CANNON D20419-16)

REAR MOUNTING


⑤ SCREW, FILH (QTY 4)
.086-56X.43
⑤ PLATE, ADAPTER
629-8671-001,-002
INSTRUMENT PANEL ③
DRI-55
622-4160-XXX
INTEGRAL TURN LOCK FASTNER
②
⑤ PLATE, MOORING
629-8672-001

FRONT MOUNTING

NOTES:

① MOUNTING SCREW LENGTHS BASED ON .125 IN. THICK INSTRUMENT PANEL AND NO SPACER PLATES.

② THIS METHOD OF INSTALLATION MAY BE USED IF INSTRUMENT PANEL IS 1.27MM [0.050 IN] TO 3.18MM [0.125 IN] THICK.

③ MOORING PLATE IS NOT REQUIRED, IF HOLES IN INSTRUMENT PANEL ARE TAPPED.

④ USE SPACER PLATE FOR FLUSH INSTALLATION ONLY, AS REQUIRED (EACH 0.100 IN THICK).

⑤ OPTIONAL FOR FRONT MOUNTING, IF INTEGRAL TURN LOCK FASTNER IS NOT USED.

TP5-3858-014

DRI-55 Digital Radio Altitude Indicator,
Typical Installations
Figure 2-24

Collins ALT-50 Radio Altimeter System (With ALT-50A for 2,000-Foot Operation)

Rockwell
International

operation

Collins General Aviation Division

Printed in USA

523-0766821-005118
5th Edition, 15 January 1988

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NOTICE: This section replaces fourth edition dated 15 January 1985.

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*List of Effective Pages	15 Jan 88
3-1 thru 3-3	15 Feb 80
3-4	15 Jan 85
3-5	15 Feb 80
3-6 Blank	15 Feb 80

Record of Revisions

RETAIN THIS RECORD IN THE FRONT OF MANUAL.
ON RECEIPT OF REVISIONS, INSERT REVISED PAGES IN THE MANUAL, AND ENTER DATE INSERTED AND INITIALS.

REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED	REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED
1st Ed	31 Aug 76		None				
2nd Ed	1 Aug 77		ALT-50A SB 1				
3rd Ed	15 Feb 80		None				
4th Ed	15 Jan 85		ALT-50A SB 2				
5th Ed	15 Jan 88		None				

section III
operation

3.1 GENERAL

The purpose of this section is to acquaint you with the operation of the ALT-50 Radio Altimeter System. A description of the displays and controls is presented. Figures 3-1 and 3-2 illustrate the controls and indicators of the 339H-4/4A Radio Altitude Indicator. Figure 3-2 also describes the function of each listed item. Figures 3-3 and 3-4 present similar information for the DRI-55 Digital Radio Altitude Indicator.

3.2 339H-4/4A RADIO ALTITUDE INDICATORS, DISPLAYS AND CONTROLS

3.2.1 Pointer and Dial Scale

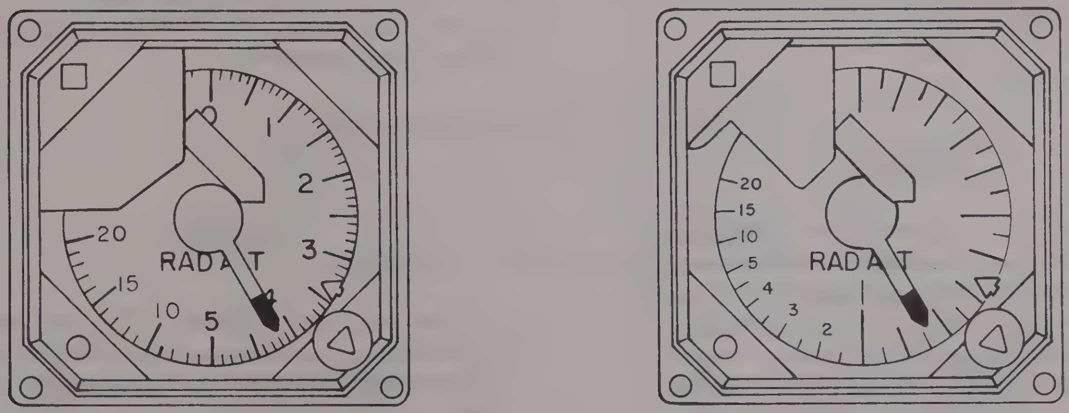
The pointer indicates aircraft height above the terrain during the approach phase of the flight. The scale of the indicators displays altitude between -20 and +2,000 feet.

The 339H-4 Radio Altitude Indicator is used primarily in fixed-wing aircraft. The display of the 339H-4 is linear from 0 to 500 feet, with major scale divisions every 50 feet and minor divisions every 10 feet. From 500 to 2,000 feet, the scale is compressed and linear with major scale marks every 500 feet and minor scale marks every 100 feet.

The 339H-4A Radio Altitude Indicator is used primarily in helicopters. The display of the 339H-4A is linear from 0 to 100 feet, with major scale divisions every 10 feet and minor divisions every 5 feet. The display is linear from 100 to 500 feet, with major scale marks every 100 feet and minor scale marks every 50 feet. From 500 to 2,000 feet, the scale is compressed and linear with major scale marks every 500 feet.

3.2.2 Decision Height (DH) Index and DH Adjustment Knob

The DH knob selects the decision height, which is displayed by the decision height index.

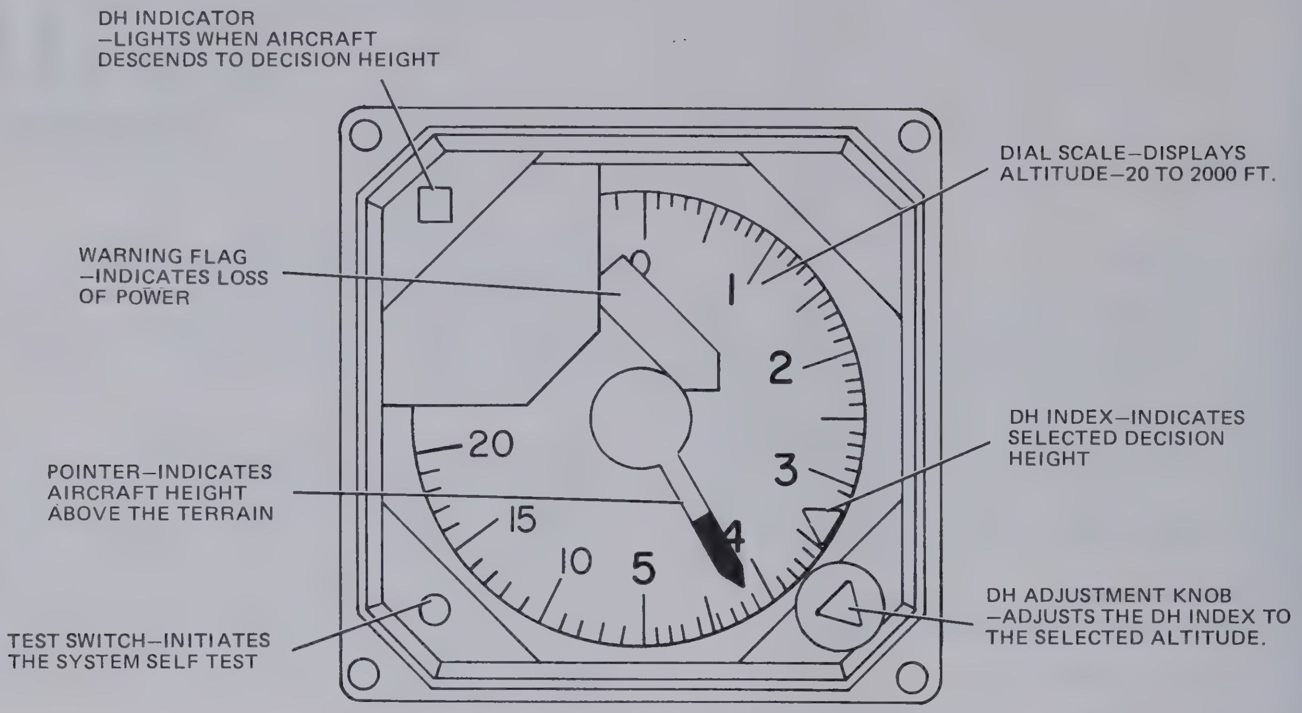


339H-4 RADIO ALTITUDE INDICATOR
(CPN 622-1204-XXX)

339H-4A RADIO ALTITUDE INDICATOR
(CPN 622-1205 -XXX)

TP4-8674-019

339H-4/4A Radio Altitude Indicator
Figure 3-1


DH INDICATOR
—LIGHTS WHEN AIRCRAFT
DESCENDS TO DECISION HEIGHT
WARNING FLAG
—INDICATES LOSS
OF POWER
POINTER—INDICATES
AIRCRAFT HEIGHT
ABOVE THE TERRAIN
TEST SWITCH—INITIATES
THE SYSTEM SELF TEST
DIAL SCALE—DISPLAYS
ALTITUDE—20 TO 2000 FT.
DH INDEX—INDICATES
SELECTED DECISION
HEIGHT
DH ADJUSTMENT KNOB
—ADJUSTS THE DH INDEX TO
THE SELECTED ALTITUDE.
0
1
2
3
4
5
10
15
20
TP4-8675-017

339H-4/4A Radio Altitude Indicator, Controls and Indicators
Figure 3-2

3.2.3 DH Indicator

The DH indicator lights when the aircraft descends to the selected decision height, as indicated by the DH index.

3.2.4 Warning Flag

Caution

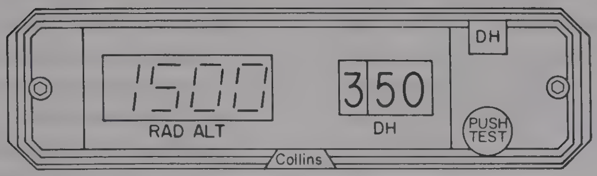
Although the ALT-50 Radio Altimeter System has been designed to exhibit a very high degree of functional integrity, the user must recognize that it is not practical to provide monitoring and/or self-test for all conceivable system failures; and, however unlikely, it is possible that erroneous operation could occur without a fault indication. It is the responsibility of the pilot to detect such an occurrence by means of cross-checks with redundant or correlated information available in the cockpit.

The warning flag indicates a loss of power whenever it comes into view during normal operation (excluding self-test). The 339H-4/4A Radio Altitude Indicators also provide an instrument flag output for an external system (such as a flight director). When power is lost, the indicator flag comes into view and the instrument flag output to the external system changes to a warn state.

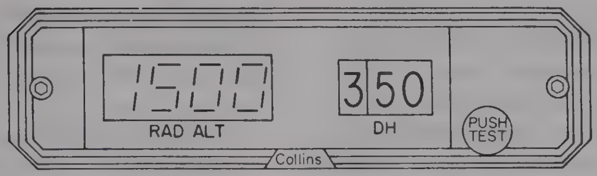
3.2.5 TEST Switch

Caution

Although the ALT-50 Radio Altimeter System has been designed to exhibit a very high degree of functional integrity, the user must recognize that it is not practical to provide monitoring and/or self-test for all conceivable system failures; and, however unlikely, it is possible that erroneous operation could occur without a fault indication. It is the responsibility of the pilot to detect such an occurrence by means of cross-checks with redundant or correlated information available in the cockpit.


DH
1500
RAD ALT
350
DH
PUSH TEST
Collins

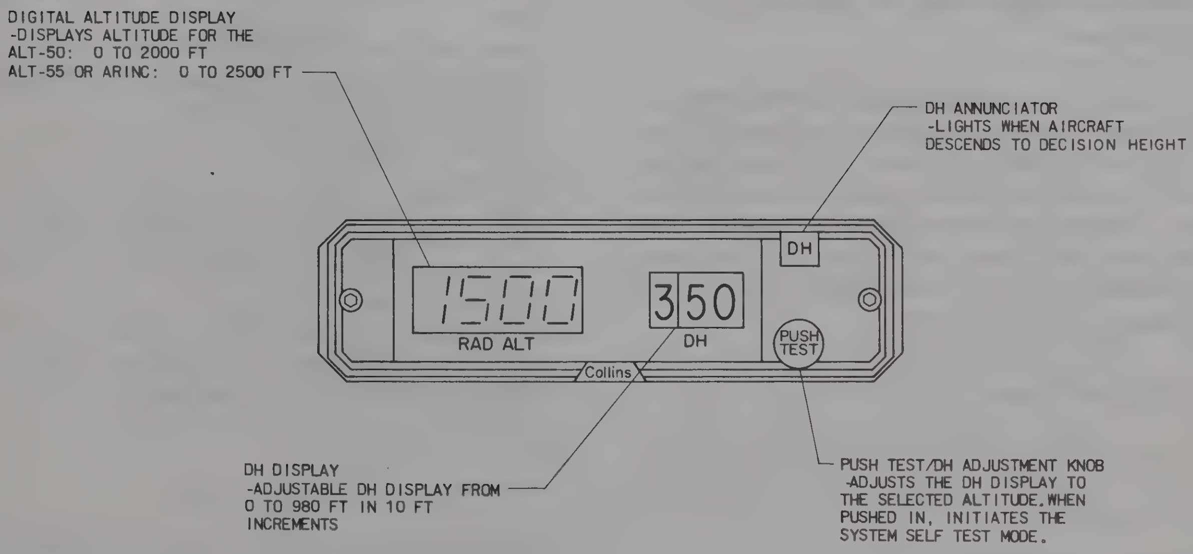
DRI-55 DIGITAL RADIO ALTITUDE INDICATOR
(CPN 622-4160-005,-006,-007,-008,-015,-016,-017,-018)


1500
RAD ALT
350
DH
PUSH TEST
Collins

DRI-55 DIGITAL RADIO ALTITUDE INDICATOR
(CPN 622-4160-001,-002,-003,-004,-011,-012,-013,-014)

TP5-3857-013

DRI-55 Digital Radio Altitude Indicator
Figure 3-3


DIGITAL ALTITUDE DISPLAY
-DISPLAYS ALTITUDE FOR THE
ALT-50: 0 TO 2000 FT
ALT-55 OR ARINC: 0 TO 2500 FT
DH ANNUNCIATOR
-LIGHTS WHEN AIRCRAFT
DESCENDS TO DECISION HEIGHT
DH
1500
RAD ALT
350
DH
PUSH TEST
Collins
DH DISPLAY
-ADJUSTABLE DH DISPLAY FROM
0 TO 980 FT IN 10 FT
INCREMENTS
PUSH TEST/DH ADJUSTMENT KNOB
-ADJUSTS THE DH DISPLAY TO
THE SELECTED ALTITUDE. WHEN
PUSHED IN, INITIATES THE
SYSTEM SELF TEST MODE.

TP5-3856-013

DRI-55 Digital Radio Altitude Indicator, Controls and Indicators
Figure 3-4

Pressing the TEST switch on the 339H-4/4A indicator initiates a functional test of the ALT-50 Radio Altimeter System (excluding antennas). When the ALT-50 system, excluding antennas, is functioning properly, the pointer indicates a self-test altitude of 50 ±5 feet, the flag comes into view, and the DH indicator lights if the DH index is set above 50 feet.

3.3 DRI-55 DIGITAL RADIO ALTITUDE INDICATOR, DISPLAYS AND CONTROLS

3.3.1 Radio Altitude Display

The radio altitude display indicates aircraft height above the terrain during the approach phase of the flight. The display increment is 10 feet below 1,000 feet and 50 feet above 1,000 feet. The display range is from 0 to 2,000 feet (when used with an ALT-50 System). Above 2,000 feet the display is blanked out.

Note

> The PUSH TEST control is a dual function control. Rotating the knob sets the decision height and pressing the knob activates the unit self-test. Each function of the control is herein after referred to by its respective name, DH knob or PUSH TEST switch.

3.3.2 Decision Height (DH) Display and DH Knob

The DH knob is a vernier adjustment that selects the decision height, which is displayed by the DH display. The decision height is selected by rotating the DH knob clockwise or counterclockwise until the DH display indicates the desired decision height. The user may set the decision height anywhere between the 10-foot increments by interpolating. The decision height range is from 0 to 980 feet.

3.3.3 DH Annunciator

The DH annunciator lights when the aircraft descends to the selected decision height, as indicated on the DH display.

3.3.4 PUSH TEST Switch

Caution

> Although the ALT-50 Radio Altimeter System has been designed to exhibit a very high degree of functional integrity, the user must recognize that it is not practical to provide monitoring and/or self-test for all conceivable system failures; and, however unlikely, it is possible that erroneous operation could occur without a fault indication. It is the responsibility of the pilot to detect such an occurrence by means of cross-checks with redundant or correlated information available in the cockpit.

Pressing the PUSH TEST switch on the DRI-55 indicator initiates a functional self-test routine of the radio altimeter system (excluding antenna). The following sequence occurs when the PUSH TEST switch is pressed and held.

a. Decision height as indicated by the DH display is displayed for 2 seconds (decision height is displayed to the nearest foot during self-test).
b. The system test altitude is displayed for 2 seconds.
c. Lamp test (8888) is displayed until the PUSH TEST switch is released.

3.4 OPERATING PROCEDURES

3.4.1 Preflight Check

a. Apply power to the ALT-50 Radio Altimeter System.
b. Adjust DH knob on indicator to set DH index to 20 feet.
c. Press and hold TEST switch on indicator and observe indicator for the following indications:
   1. Pointer indicates 50 ±5 feet.
   2. DH indicator is off.
   3. Flag is in view.
d. With TEST switch depressed, slowly adjust DH knob to increase DH index altitude indication, and verify that DH indicator lights when DH index is between 45 and 55 feet.
e. Release TEST switch and observe indicator. Warning flag should be out of view and altitude indicator should be 0 foot nominal.

3.4.2 Flight Operation

3.4.2.1 Cruise Altitude Operation

At normal cruise altitudes and any altitude above 2,000 feet, the pointer on the indicator is behind the mask and the flag is out of view. An FCS warn output is applied to the flight control system (flight director/autopilot) indicating that usable radio altitude information is not available.

The pointer comes into view at cruise altitude when the aircraft flies within 2,000 feet of the terrain.

3.4.2.2 *Approach Phase Operation*

Caution

ALT-50 Radio Altimeter Systems that utilize the optional DRI-55 Digital Radio Altitude Indicator should not have a functional self-test performed during the approach phase of aircraft operation. The functional self-test, initiated by depressing the PUSH TEST switch on the DRI-55, causes the DRI-55 to display self-test information for a minimum of four seconds. During the four seconds (minimum) self-test time period, the ALT-50 Radio Altimeter System altitude information is not displayed on the DRI-55.

Before initiating an approach, the pilot should check the radio altimeter system, using the self-test feature. Before or immediately after beginning the approach phase at 2,000 feet, the pilot should adjust the DH knob to set the DH index on the published decision altitude for the facility being used. When the aircraft descends to the selected decision height, the DH indicator lights to alert the pilot that a continue-approach or go-around decision must be made.

Caution

Although the ALT-50 Radio Altimeter System has been designed to exhibit a very high degree of functional integrity, the user must recognize that it is not practical to provide monitoring and/or self-test for all conceivable system failures; and, however unlikely, it is possible that erroneous operation could occur without a fault indication. It is the responsibility of the pilot to detect such an occurrence by means of cross-checks with redundant or correlated information available in the cockpit.

Note

Detection of possible in-flight radio altimeter malfunctions should be maximized by utilization of the self-test function immediately prior to the approach phase of the flight, and by cross-referencing to the barometric altimeters below 2,000 feet.

During the descent, the radio altimeter system provides altitude and altitude trip information to the flight control system (flight director/autopilot).

After landing, the DH indicator can be turned off by adjusting the DH knob fully counterclockwise.

3.4.3 *Points to Remember*

a. In some installations, the altimeter indicator may read less than zero altitude on the ramp. This is a normal phenomenon in aircraft whose altimeter antennas are nearer the ground on the ramp than at touchdown.

b. The radio altimeter is intended to give accurate altitude information over a wide variety of terrain characteristics. Altimeter accuracy may be affected, however, under exceptional circumstances. The dominant reflecting surface may not coincide with treetop level when flying over triple-tier jungle or with the top of the snow when flying over very deep, fluffy snow.

c. The time-constant of the radio altimeter is about 90 milliseconds. While this allows the altimeter output to follow most terrain accurately, the altimeter will not respond to extremely rapid fluctuations in terrain.

d. At extreme pitch or roll, altimeter accuracy may be impaired.

e. Frequent use of the self-test feature, especially before take-off and at the beginning of the approach, will enhance probability of detecting possible altimeter system malfunctions.

Collins ALT-50 Radio Altimeter System (With ALT-50A for 2,000-Foot Operation)

Rockwell
International

theory

Collins General Aviation Division

Printed in USA

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NOTICE: This section replaces third edition dated 15 January 1985.

List of Effective Pages

*The asterisk indicates pages changed, added, or deleted by the current change.

Page No	Issue
*Title	15 Jan 88
*List of Effective Pages	15 Jan 88
*4-1 thru 4-34	15 Jan 88

Record of Revisions

RETAIN THIS RECORD IN THE FRONT OF MANUAL.
ON RECEIPT OF REVISIONS, INSERT REVISED PAGES IN THE MANUAL, AND ENTER DATE INSERTED AND INITIALS.

REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED	REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED
1st Ed	31 Aug 76		None				
1	1 Aug 77		ALT-50A SB 1				
2nd Ed	15 Feb 80		None				
3rd Ed	15 Jan 85		ALT-50A SB 2				
4th Ed	15 Jan 88		None				

section IV
theory

4.1 GENERAL

The ALT-50 Radio Altimeter System (with ALT-50A for 2,000-foot operation) transmits, receives, and processes frequency-modulated, continuous-wave (FMCW) signals to produce a dc analog altitude signal proportional to the aircraft altitude above the terrain. The altitude is indicated on the 339H-4/4A Radio Altitude Indicator or another compatible indicator.

4.2 PRINCIPLES OF RADIO ALTIMETER SYSTEMS

The ALT-50A Radio Altimeter Receiver-Transmitter applies a signal to the transmit antenna. The transmit antenna beams the signal to the terrain, and the terrain reflects the signal back to the receive antenna. The returning signal is applied to the receiver section of the ALT-50A. The altitude of the aircraft above the terrain is proportional to the time required for the transmit signal to make a round trip to the terrain and return to the radio altimeter. The signal is continuous, and within the maximum range of the altimeter, provides constant altitude information which is displayed on the radio altitude indicator.

Radio waves propagate 186,280 statute miles per second, which corresponds to 0.984 ft per nanosecond. It therefore takes rf 1.0163 nanoseconds to travel 1 ft in free space, which corresponds to 2.0326 nanoseconds per ft of altitude. During the following explanations the numbers are rounded off and the propagation rate of rf through free space is considered to be 1 ns per ft, which corresponds to 2 ns per ft of altitude.

Figure 4-1 is a block diagram of a basic altimeter system. The modulator produces the modulation waveform that is applied to the transmitter and sets the transmitter frequency deviation rate. In the ALT-50A the transmitter frequency deviation is set at 20 Hz per nanosecond. The transmitter rf is applied to the transmit antenna and a sample is fed to the receiver. The path length to the terrain and back is twice the altitude and therefore the rf signal must travel 2 ft, which takes 2 ns per foot of altitude, during which time the transmitter output frequency shifts 40 Hz. In the receiver, the transmitter frequency shift is determined by mixing the sample and return signal which produces a receiver if that changes 40 Hz per foot of altitude. The altitude processor converts the receiver if to an analog that can be displayed and utilized by other aircraft systems.

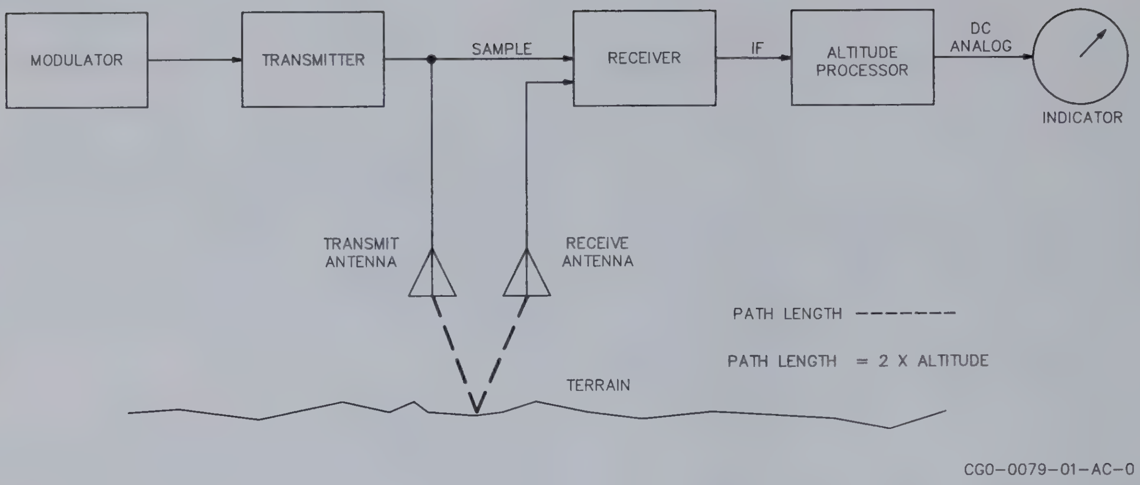
Figure 4-2 pictorially illustrates the development of the receiver if that was just explained. The base of the diagram is time and the vertical axis is frequency. The time and frequencies shown are typical of the ALT-50A. The heavy dashed line is offset to the right from the transmit signal to represent the amount of delay incurred by altitude and is exaggerated for purposes of explanation. The difference between the transmit signal and the received signal is the receiver if. The if is also developed on the downward sweeps of the transmitter frequency and although the diagram only examines one instant in time, the if is continuously developed anytime the system is turned on.

Turnaround-time is the time period from when the transmitter frequency deviation changes direction until the received frequency deviation changes direction. During turnaround-time the receiver if is disrupted. The length of time the if is disrupted is a variable and increases with altitude, however at 2,500 feet it is only slightly longer than 5 microseconds and therefore is too short in duration to disrupt the altitude display.

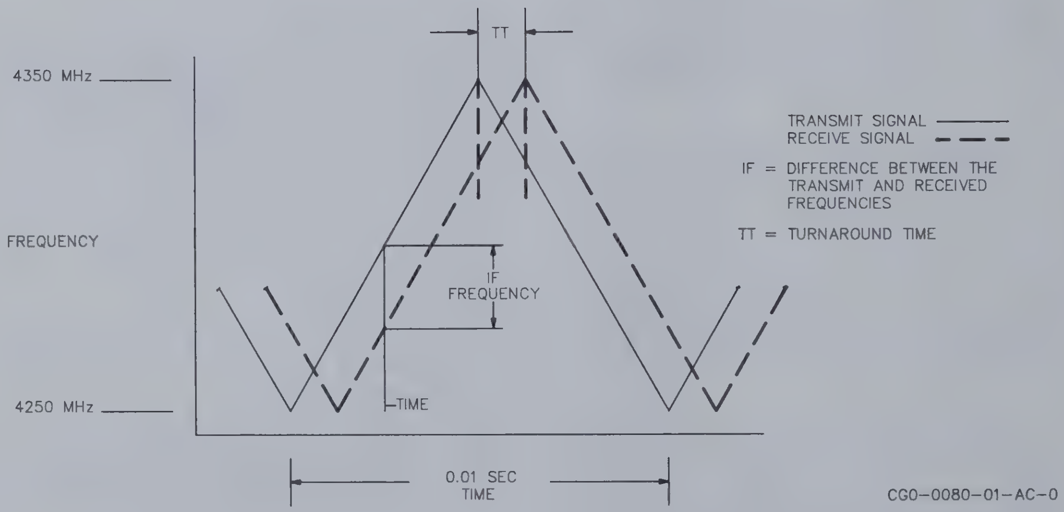
4.3 BASIC PRINCIPLES OF OPERATION BY FUNCTION

4.3.1 ALT-50 Radio Altimeter System (With ALT-50A for 2,000-Foot Operation), Principles of Operation (Refer to figure 4-3)

An altitude indication is accomplished by producing a dc analog voltage that is proportional to the amount of time required for a FMCW signal to make a round trip from the transmit antenna to the receive antenna. This period of time includes the aircraft installation delay (AID).


MODULATOR
TRANSMITTER
SAMPLE
RECEIVER
IF
ALTITUDE PROCESSOR
DC ANALOG
INDICATOR
TRANSMIT ANTENNA
RECEIVE ANTENNA
PATH LENGTH ------
PATH LENGTH = 2 X ALTITUDE
TERRAIN
CG0-0079-01-AC-0

Basic Altimeter, Block Diagram
Figure 4-1



Receiver IF Development
Figure 4-2

The received signal is heterodyned with the transmit signal producing a difference signal proportional to the time required for the round trip to the terrain. The difference or altitude signal frequency is equal to 40 Hz per foot of altitude. The altitude signal is a sine wave signal that is applied to the preamplifier.

The preamplifier consists of a low noise front end with high-pass gain shaping that increases the gain with increasing altitude. The amplified signal is applied to a 3-section, low-pass filter. When the self-test input is applied to the preamplifier, the preamplifier switches and applies the self-test altitude to the low-pass filter.

Four bandwidths are available in the 3-section, low-pass filter. The dc analog altitude signal from the analog output driver is applied to the filter control logic and selects the correct bandwidth. The filter removes the high-frequency noise from the altitude signal.

From the 3-section, low-pass filter, the signal is applied to the zero crossing detector and the signal presence detector. The zero crossing detector detects each zero crossing of the sine wave altitude signal. The detector applies a square wave with the same frequency as the sine wave input to the time domain filter.

The signal presence detector determines if the signal strength is sufficient to provide an accurate altitude signal. When the signal strength is sufficient, the detector applies an enable signal to the time domain filter. The enable signal allows the time domain filter output to be applied to the frequency-to-voltage converter.

When the time domain filter is enabled, it converts the square wave altitude input signal to a 60/40 rectangular wave to remove extraneous noise and to provide additional signal stabilization. An output trigger pulse is applied from the filter to the frequency-to-voltage converter when an enable signal is applied to the filter. The frequency of this trigger pulse is the same as the square wave input frequency.

The trigger pulse input is integrated by the frequency-to-voltage converter. Because of a large time constant, the converter integrates the pulse input into an analog dc voltage. The analog varies according to the frequency of the pulses. When the trigger pulse input is of a high frequency, the analog output will be a high dc voltage level. When the trigger pulse input is of a lower frequency, the dc voltage output will be lower.

The dc analog voltage is applied to the FCS warn circuit and analog output driver. Refer to figure 4-4. The dc analog voltage from -20 to 500 feet is 20 millivolts per foot, and from 500 to 2,000 feet it is 10.4 volts plus 3 millivolts per foot.

When the signal strength is insufficient for an accurate altitude indication, the time domain filter input to the frequency-to-voltage converter is removed and the converter applies a +18-V dc bias signal to the analog output driver which drives the pointer on the 339H-4/4A Radio Altitude Indicator off scale and behind the mask.

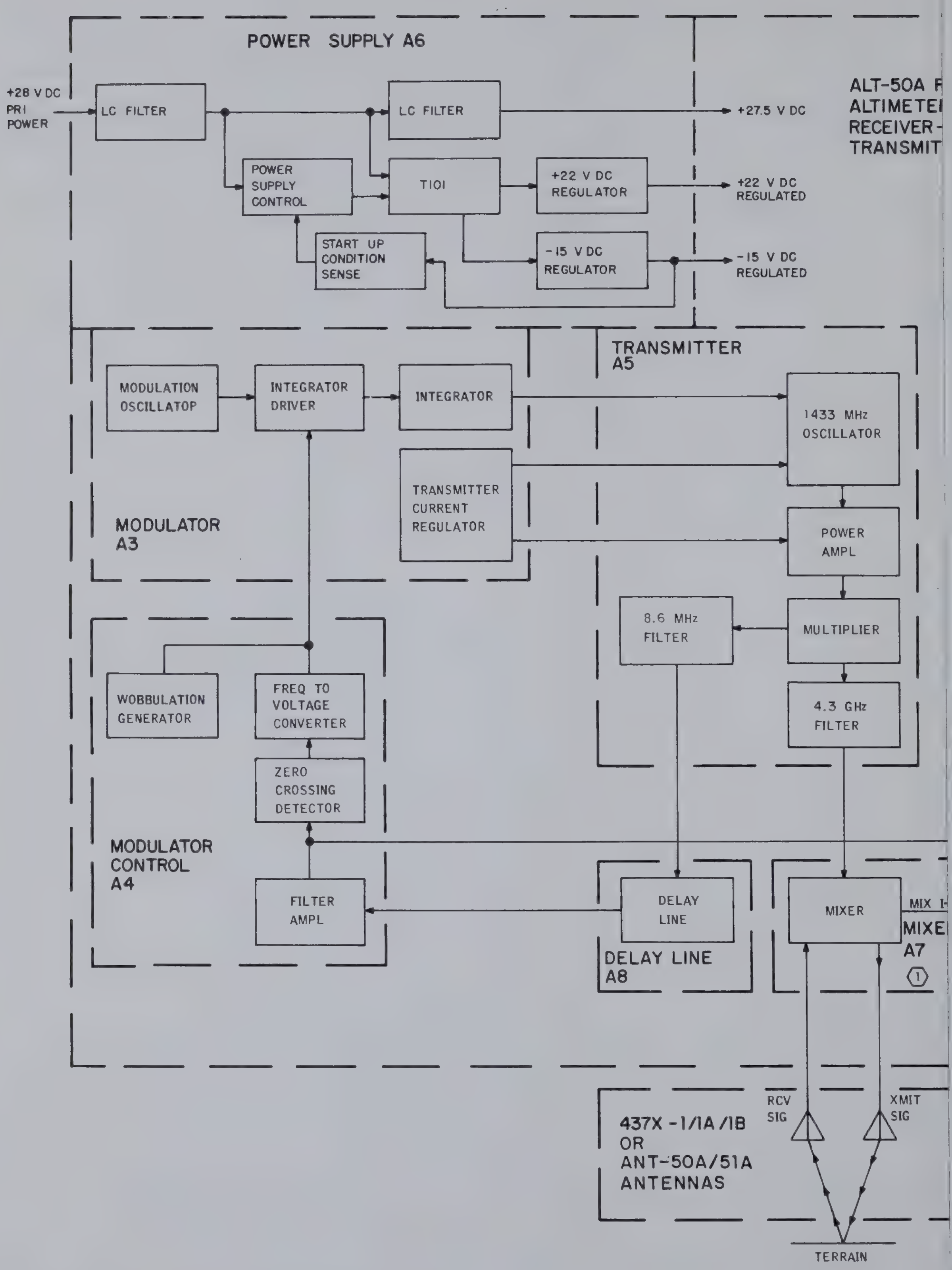
Aircraft installation delays (AID) are adjusted to provide an accurate altitude indication when the aircraft is in a touchdown attitude. The delays are caused by the antenna height above the ground at touchdown attitude and the length of the cables between the receiver-transmitter and the antennas. The delays are adjusted to give a 0-foot-altitude indication at touchdown. The AID common is connected to the required 20-, 40-, or 57-foot AID in the interconnect wiring harness. The appropriate AID bias is applied to the frequency-to-voltage converter. The converter adjusts the altitude signal to allow for the AID and provides an accurate dc analog altitude voltage output. When the system is placed in self-test, the AID compensation is removed.

The dc analog voltage is also applied to four shop-adjustable altitude trips. The trips can be adjusted to any altitude between 0 and 2,000 feet. The trip circuits detect when the aircraft descends to the point at which the trip is set, at which time the trip will switch from an open to a direct short to ground.

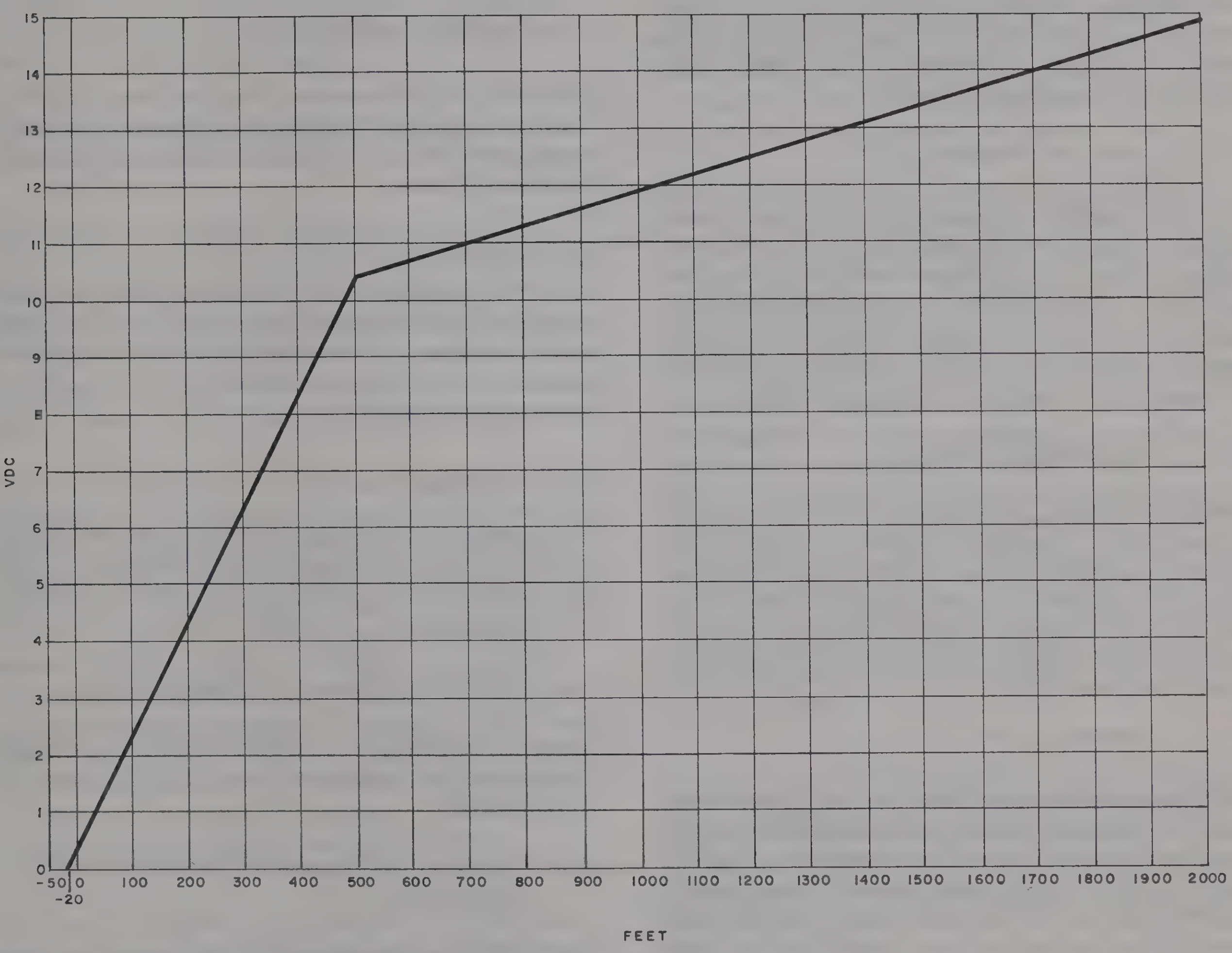
The FCS warn circuit detects when the frequency-to-voltage converter circuit changes from an analog altitude voltage output to an off-scale bias output and applies an FCS warn output to the flight control system. When primary power is lost or the system is placed in self-test, the FCS warn also applies a warn output to the flight control system. The off-scale bias warn occurs when the aircraft is above the altimeter system range (2,000 feet) or the input signal is too weak.

4.3.1.1 ALT-50A Radio Altimeter Receiver-Transmitter, Basic Principles of Operation

The ALT-50A is a completely solid-state FMCW transmitter-receiver that operates in the 4250- to 4350-MHz frequency range. The system beams the


POWER SUPPLY A6
+28 V DC
PRI
POWER
LC FILTER
LC FILTER
+27.5 V DC
ALT-50A F
ALTIMETEI
RECEIVER-
TRANSMIT
POWER
SUPPLY
CONTROL
TIOI
+22 V DC
REGULATOR
+22 V DC
REGULATED
START UP
CONDITION
SENSE
-15 V DC
REGULATOR
-15 V DC
REGULATED
TRANSMITTER
A5
MODULATION
OSCILLATOR
INTEGRATOR
DRIVER
INTEGRATOR
1433 MHz
OSCILLATOR
TRANSMITTER
CURRENT
REGULATOR
MODULATOR
A3
POWER
AMPL
8.6 MHz
FILTER
MULTIPLIER
WOBBULATION
GENERATOR
FREQ TO
VOLTAGE
CONVERTER
4.3 GHz
FILTER
ZERO
CROSSING
DETECTOR
MODULATOR
CONTROL
A4
FILTER
AMPL
DELAY
LINE
MIXER
MIX I-
MIXE
A7
①
DELAY LINE
A8
437X -1/1A/1B
OR
ANT-50A/51A
ANTENNAS
RCV
SIG
XMIT
SIG
TERRAIN

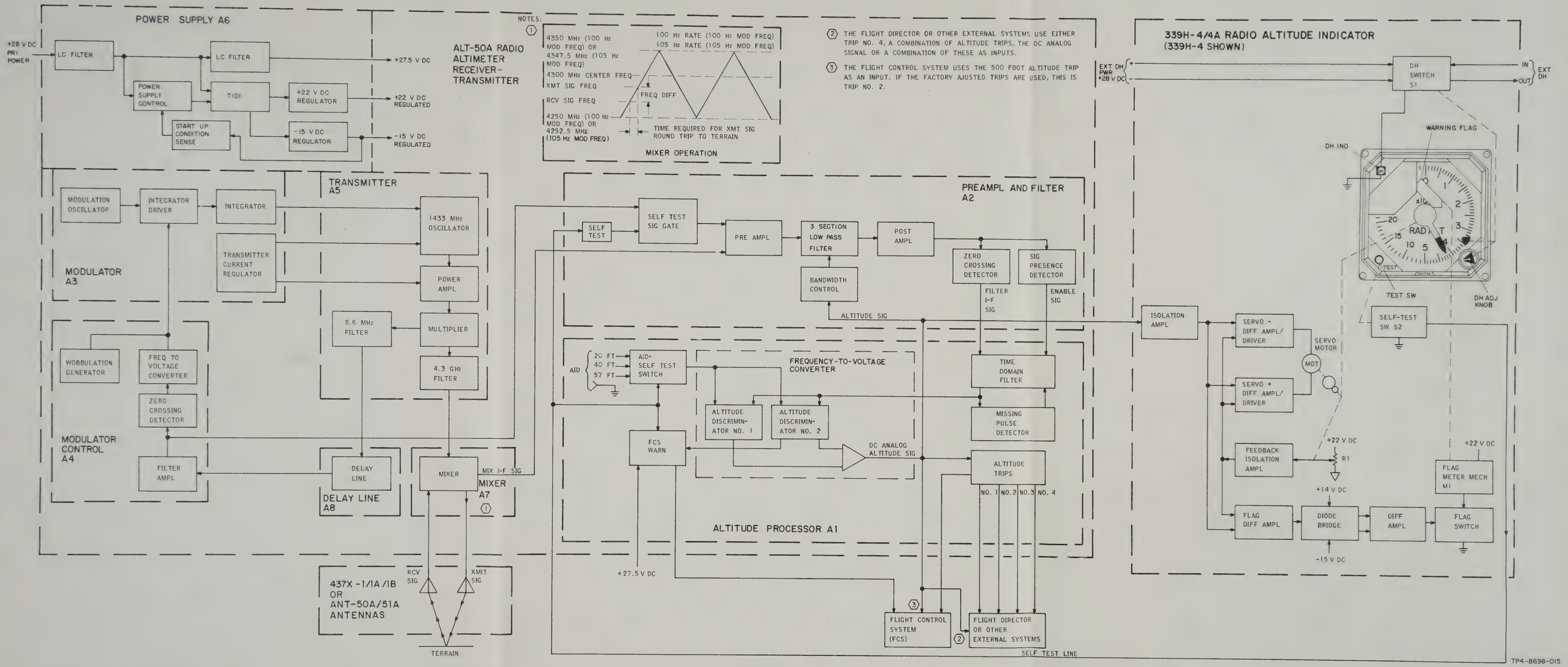
ALT-50 Radio Altimeter System (With ALT-50A for 2,000-Foot Operation), System Block Diagram
Figure 4-3



NOTE:
ANALOG PLOTTED USING THE FOLLOWING FORMULAS:
0 TO 500 FT;
$V = 0.4 + (0.02 \times H)$
500 TO 2000 FT;
$V = 10.4 + [0.003 \times (H - 500)]$

TP3-2084-011

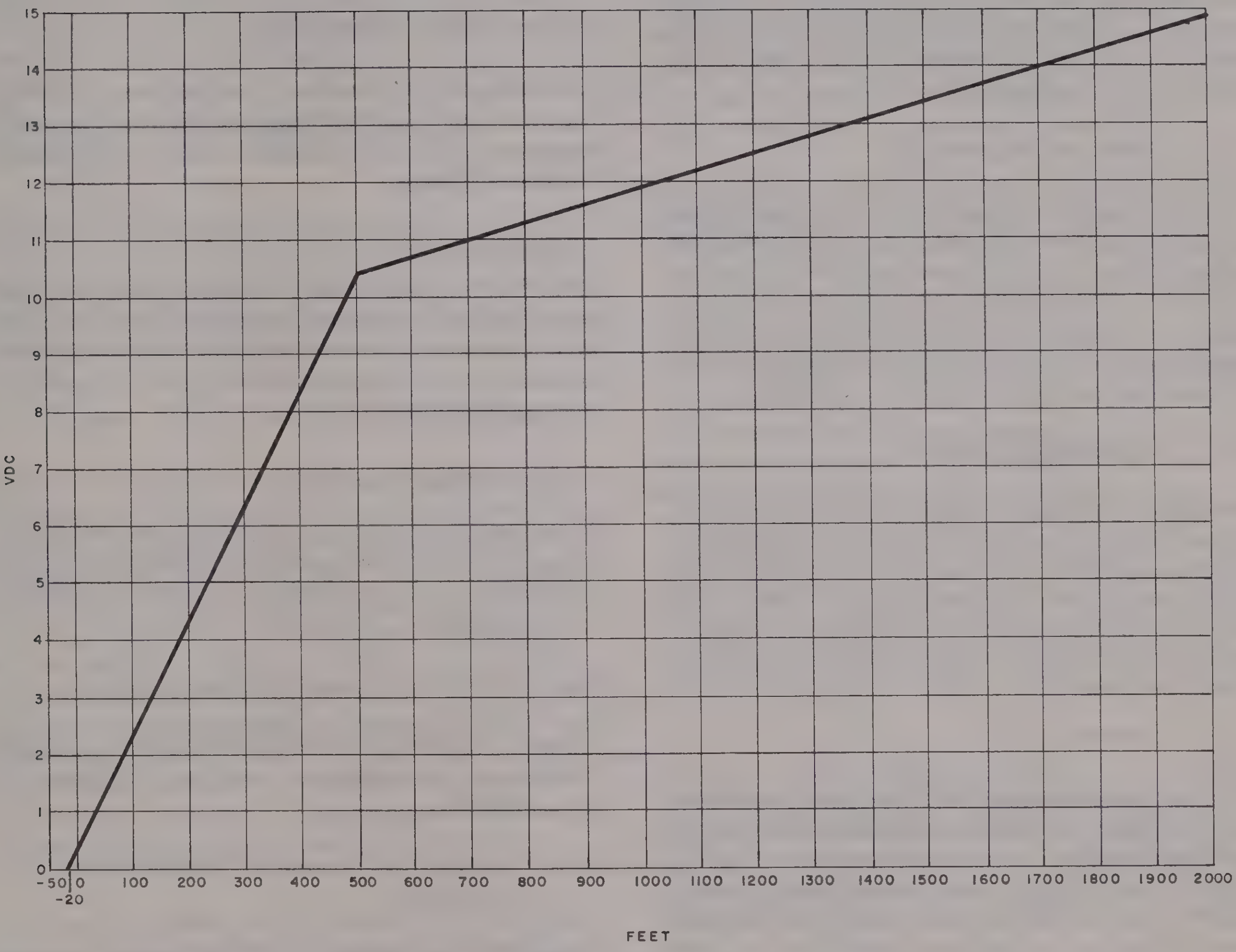
DC Analog Altitude Signal, Voltage Chart
Figure 4-4


POWER SUPPLY A6
+28 V DC PRI POWER
LC FILTER
LC FILTER
+27.5 V DC
POWER SUPPLY CONTROL
TIOI
+22 V DC REGULATOR
+22 V DC REGULATED
START UP CONDITION SENSE
-15 V DC REGULATOR
-15 V DC REGULATED
ALT-50A RADIO ALTIMETER RECEIVER-TRANSMITTER
NOTES:
①
4350 MHz (100 Hz MOD FREQ) OR 4347.5 MHz (105 Hz MOD FREQ)
4300 MHz CENTER FREQ
XMT SIG FREQ
RCV SIG FREQ
4250 MHz (100 Hz MOD FREQ) OR 4252.5 MHz (105 Hz MOD FREQ)
100 Hz RATE (100 Hz MOD FREQ)
105 Hz RATE (105 Hz MOD FREQ)
FREQ DIFF
TIME REQUIRED FOR XMT SIG ROUND TRIP TO TERRAIN
MIXER OPERATION
MODULATION OSCILLATOR
INTEGRATOR DRIVER
INTEGRATOR
TRANSMITTER CURRENT REGULATOR
MODULATOR A3
TRANSMITTER A5
1433 MHz OSCILLATOR
POWER AMPL
MULTIPLIER
8.6 MHz FILTER
4.3 GHz FILTER
WOBBULATION GENERATOR
FREQ TO VOLTAGE CONVERTER
ZERO CROSSING DETECTOR
MODULATOR CONTROL A4
FILTER AMPL
DELAY LINE
DELAY LINE A8
MIXER
MIX I-F SIG
MIXER A7
①
437X-1/1A/1B OR ANT-50A/51A ANTENNAS
RCV SIG
XMIT SIG
TERRAIN
SELF TEST
SELF TEST SIG GATE
PRE AMPL
3 SECTION LOW PASS FILTER
BANDWIDTH CONTROL
POST AMPL
ZERO CROSSING DETECTOR
SIG PRESENCE DETECTOR
FILTER I-F SIG
ENABLE SIG
PREAMPL AND FILTER A2
ALTITUDE SIG
AID
20 FT
40 FT
57 FT
AID-SELF TEST SWITCH
FREQUENCY-TO-VOLTAGE CONVERTER
ALTITUDE DISCRIMIN-ATOR NO. 1
ALTITUDE DISCRIMIN-ATOR NO. 2
DC ANALOG ALTITUDE SIG
FCS WARN
TIME DOMAIN FILTER
MISSING PULSE DETECTOR
ALTITUDE TRIPS
NO. 1
NO. 2
NO. 3
NO. 4
ALTITUDE PROCESSOR A1
+27.5 V DC
③
FLIGHT CONTROL SYSTEM (FCS)
②
FLIGHT DIRECTOR OR OTHER EXTERNAL SYSTEMS
SELF TEST LINE
339H-4/4A RADIO ALTITUDE INDICATOR (339H-4 SHOWN)
EXT DH PWR +28 V DC
+
-
DH SWITCH S1
IN
OUT
EXT DH
WARNING FLAG
DH IND
x10
RAD ALT
TEST
TEST SW
DH ADJ KNOB
ISOLATION AMPL
SELF-TEST SW S2
SERVO - DIFF AMPL/DRIVER
SERVO MOTOR
MOT
SERVO + DIFF AMPL/DRIVER
+22 V DC
R1
+14 V DC
FEEDBACK ISOLATION AMPL
+22 V DC
FLAG METER MECH M1
FLAG DIFF AMPL
DIODE BRIDGE
DIFF AMPL
FLAG SWITCH
-15 V DC
TP4-8698-015

② THE FLIGHT DIRECTOR OR OTHER EXTERNAL SYSTEMS USE EITHER TRIP NO. 4, A COMBINATION OF ALTITUDE TRIPS, THE DC ANALOG SIGNAL OR A COMBINATION OF THESE AS INPUTS.

③ THE FLIGHT CONTROL SYSTEM USES THE 500 FOOT ALTITUDE TRIP AS AN INPUT. IF THE FACTORY AJUSTED TRIPS ARE USED, THIS IS TRIP NO. 2.

ALT-50 Radio Altimeter System (With ALT-50A for 2,000-Foot Operation), System Block Diagram
Figure 4-3



NOTE:
ANALOG PLOTTED USING THE FOLLOWING FORMULAS:
0 TO 500 FT;
$V = 0.4 + (0.02 \times H)$
500 TO 2000 FT;
$V = 10.4 + [0.003 \times (H - 500)]$

TP3-2084-011

DC Analog Altitude Signal, Voltage Chart
Figure 4-4

FMCW signal to the terrain, receives the reflected transmit signal, and converts the reflected signal to a dc analog voltage proportional to the aircraft altitude above the terrain.

The ALT-50A contains four shop adjustable altitude trips that can be adjusted from 0 to 2,000 feet but are factory set at 200, 500, 1,000, and 1,500 feet. Three AID options are provided for 20, 40, and 57 feet, and the specific AID is selected during installation in the aircraft.

The ALT-50A consists of eight modules: altitude processor A1, preamplifier/filter A2, modulator A3, modulator control A4, transmitter A5, power supply A6, mixer A7, and delay line A8.

4.3.1.1.1 Altitude Processor A1

Altitude processor A1 consists of the time domain filter, missing pulse detector, altitude discriminators numbers 1 and 2, AID bias circuit, sum amplifier, FCS warn, and altitude trip circuits numbers 1 through 4. The altitude processor converts the if signal to a dc analog altitude voltage and provides an FCS warn output and altitude trip outputs.

4.3.1.1.2 Preamplifier/Filter A2

Preamplifier/filter A2 consists of the preamplifier, low-pass filter, bandwidth control, postamplifier, zero crossing detector, signal presence detector, and self-test signal gate. The preamplifier/filter circuits process the if signal from the mixer or the self-test signal to provide an amplified and filtered if signal to altitude processor A1.

4.3.1.1.3 Modulator A3

Modulator A3 consists of the modulation oscillator, integrator driver, integrator, and transmitter current regulator circuits. The modulator provides a 100-Hz $\underline{\angle 0^\circ}$ or 105-Hz $\underline{\angle 180^\circ}$ modulation signal that is applied to the transmitter. Modulation frequency and phase difference provide the capability for dual-system installations with minimum interference between the systems.

4.3.1.1.4 Modulator Control A4

Modulator control A4 consists of the filter/amplifier, zero crossing detector, frequency-to-voltage converter, and wobbulation generator circuits. The modulator control filters and amplifies the 50-foot self-test signal applied to preamplifier/filter A2 and provides the control voltage that is applied to modulator A3 to ensure correct deviation of the transmitter signal.

4.3.1.1.5 Transmitter A5

Transmitter A5 consists of an FM oscillator, power amplifier, times-3 multiplier, filter, and doubler circuits. All circuits in the transmitter are strip line. The transmitter produces the 4250- to 4350-MHz transmit signal and, in conjunction with delay line A8, produces the 50-foot self-test altitude signal.

4.3.1.1.6 Power Supply A6

Power supply A6 consists of an inverter, +22-V dc regulator, and -15-V dc regulator circuits. The power supply provides the dc voltages for the ALT-50 Radio Altimeter System.

4.3.1.1.7 Mixer A7

Mixer A7 consists of two circulators and a hybrid mixer circuit. All mixer circuits are strip line. The mixer combines the transmit and receive signals to produce an if altitude signal that is applied to preamplifier/filter A2.

4.3.1.1.8 Delay Line A8

Delay line A8 consists of a delay line and a filter circuit. The delay line operates in conjunction with transmitter A5 to produce the 50-foot self-test altitude signal.

4.3.1.2 339H-4/4A Radio Altitude Indicator

Refer to the 339H-4/4A description section (CPN 523-0764965) of this instruction book for a discussion of the indicators.

4.3.1.3 437X-1/1A/1B and ANT-50A/51A/52 Antennas

The 437X-1/1A/1B and the ANT-50A/51A/52 Antennas (two required per system) are used in the radio altimeter system to transmit and receive the rf energy beamed to the terrain and reflected back to the aircraft.

The antennas (except ANT-52) are linearly polarized horn antennas, flush mounted on the underside of the aircraft. The antenna aperture is covered by a radome that provides a smooth surface, flush with the antenna mounting flange. The antenna assembly contains foamed plastic for support of the radiating elements and for minimizing differential pressures. A type TNC female connector projects from the antenna body and includes provisions for safety wiring of the mating TNC connector.

4.4 DETAILED PRINCIPLES OF OPERATION

The following discussion of the detailed principles of operation is supplemented with functional block diagrams and simplified schematic diagrams that are correlated to the overall block diagram and schematic by component reference designator or the reference designator of the circuit board.

4.4.1 ALT-50A Radio Altimeter Receiver-Transmitter

The detailed principles of operation for the ALT-50A are discussed in the following order: power supply A6, modulator A3, modulator control A4, transmitter A5 and delay line A8, mixer A7, preamplifier/filter A2, and altitude processor A1.

4.4.1.1 Power Supply A6 (Refer to figure 4-5)

Plus 28 V dc aircraft power from rear connector P1-9 is applied to power supply terminal 12 and filtered by L101 and C115. The LC filter removes spurious spikes and noise from the aircraft bus voltage and applies the filtered +28 V dc through CR101 to filter C101, C102, and C103. Diode CR101 prevents damage from negative polarity voltage or spikes, and the filter removes ac ripple. The resulting +27.5 V dc is applied through voltage divider R201, R202, and R203 to the noninverting input of input voltage monitor/comparator U203. Capacitor C201 allows the power supply to continue operating if momentary low-voltage transients should occur on the +28-V dc bus.

The output at U203-4 is a nominal +7.15 V dc. This voltage is applied to the inverting input of U203 through voltage divider R206 and R207. The voltage divider provides a nominal +4.0-V dc reference voltage to U203. U203 acts as a comparator and if the voltage at the noninverting input of U203 drops below the +4.0-V dc reference level, U203 provides a logic 0 at U203-6 and inhibits Q204. If the voltage at the noninverting input of U203 is at or above +4.0 V dc, U203-6 is a logic 1 (approximately +7.1 V dc at the anode of CR201) and Q204 turns on, enabling amplifier Q201, driver amplifier Q202, and thus the power supply circuit. The power supply circuits will operate if the primary input voltage is at least +22 V dc. Resistor R204 provides hysteresis in the input voltage monitor circuit. The nominal +7.15-V dc output at U203-4 is also applied to the base of pass transistor Q205. The voltage drop from base to emitter to Q205 provides a nominal +6.5 V dc at Q205 emitter that is only used internally in the power supply.

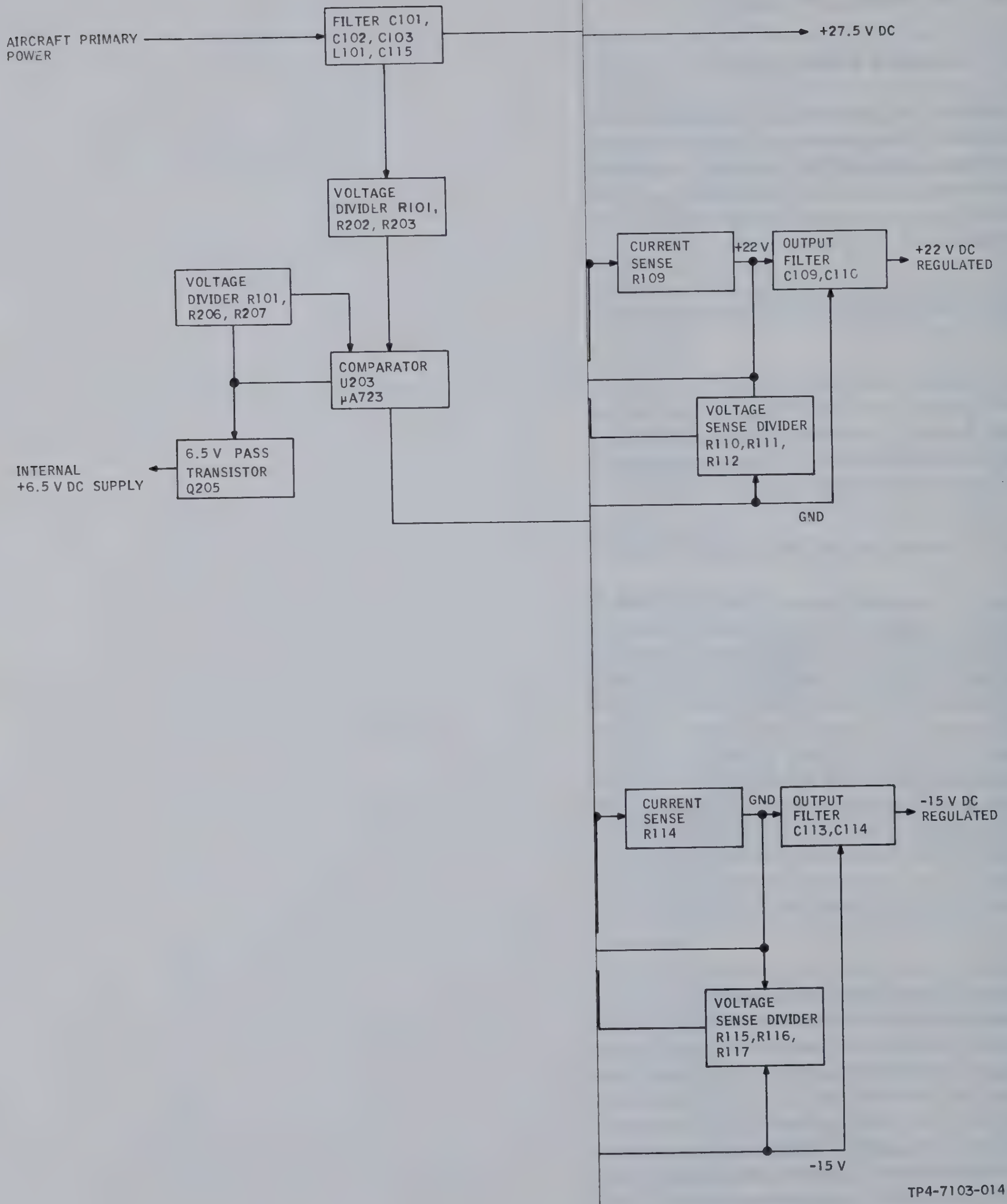
U201 is a 10-kHz clock with the frequency being determined by C203, R211, and R212. Capacitor C205 provides protection from transient spikes, and C204 provides stabilization. The 10-kHz output at U201-3 is applied to differentiator C206, R213, and R224. The resulting spikes are applied to the trigger input of U202. U202 provides a 10-kHz signal with a duty cycle that is controlled so as to maintain the rectified T101 secondary voltages at the proper levels.

The on time of the U202 output signal is determined by C208 and R219 and the voltage applied to the base of Q203. Transistor Q203 senses the voltage present at test jack J2 (+27.3 V dc nominal). An increase of voltage at J2 causes the Q203 current to decrease, thus decreasing the voltage at U202-5. This causes U202 to produce a shorter time period for the positive portion of the output pulse which, in turn, decreases the voltage at J2. If the voltage at J2 is too low, the Q203 current increases and the length of the time period for the positive portion of the output pulse increases, tending to restore the proper voltage at J2. Diodes CR106 and CR107 provide temperature compensation to ensure that the power supply preregulation will be adequate over the entire operating temperature range. The preregulated voltage at J2 is used to control the dc voltage applied to the +22- and -15-V dc regulators.

The output from U202 is applied to driver amplifier Q201. Transistor Q201 is enabled by the comparator action of U203. When U203 turns on Q204, Q201 is on and the drive to the primary of T101 is enabled. If U203 turns off Q204, Q201 is inhibited and the drive to T101 is stopped.

Resistor R103 provides current sensing of T101 primary winding current. If the current at test jack J1 is abnormally high, it turns on Q206, which turns off U202 until the next trigger pulse occurs.

Transistor Q101 alternately opens and closes the primary of T101 (pins 5 and 6) from a nominal +27.5 V dc to ground. T101 provides two secondary outputs. The output from secondary pins 1 and 2 is applied through rectifier CR103 and filter C104 and through


AIRCRAFT PRIMARY POWER
FILTER C101, C102, C103 L101, C115
+27.5 V DC
VOLTAGE DIVIDER R101, R202, R203
VOLTAGE DIVIDER R101, R206, R207
COMPARATOR U203 µA723
6.5 V PASS TRANSISTOR Q205
INTERNAL +6.5 V DC SUPPLY
CURRENT SENSE R109
+22 V
OUTPUT FILTER C109,C110
+22 V DC REGULATED
VOLTAGE SENSE DIVIDER R110,R111, R112
GND
CURRENT SENSE R114
GND
OUTPUT FILTER C113,C114
-15 V DC REGULATED
VOLTAGE SENSE DIVIDER R115,R116, R117
-15 V
TP4-7103-014

Power Supply A6, Block Diagram
Figure 4-5

C105 to regulator control U101 and pass transistor Q102. Regulator control U101 provides a control voltage that is applied to the base of Q102, and the current flow through pass transistor Q102 is controlled to produce the regulated +22.000-V dc output.

Resistor R109 connected between U101 pins 10 and 1 provides current sensing for the +22-V dc output, and C109 and C110 provide output filtering. Regulated +22 V dc is applied through voltage divider R110, R111, and R112 to U101-2 as an inverting voltage sensing input. Potentiometer R111 is adjusted to set the output of Q102 at +22.000 V dc. The regulated +22 V dc is also applied to rear connector P1-35 (modulator frequency common), to rear connector P1-49, and to the internal ALT-50A circuits.

The output from secondary pins 3 and 4 of T101 is applied through rectifier CR104 and filter capacitor C106 to regulator control U102 and pass transistor Q103. Regulator control U102 provides a control voltage that is applied to the base of Q103, and the current flow through pass transistor Q103 is controlled to produce the regulated -15.000-V dc output.

Resistor R114 connected between U102 pins 10 and 1 provides current sensing for the -15-V dc output, and C113 and C114 provide output filtering. Regulated -15 V dc is applied through voltage divider R115, R116, and R117 to U102-2 as an inverting voltage sensing input. Potentiometer R116 is adjusted to set the output of Q103 at -15.000 V dc. Regulated -15 V dc is also applied to rear connector P1-51 and to the internal ALT-50A circuits.

During initial startup, current flow through the primary of T101 is controlled by a startup condition sense circuit consisting of CR105, R106, R107, and VR102. As soon as +28 V dc power is applied, the junction of R106 and R107 becomes approximately +6.5 V dc. This forward biases CR105 and turns on Q206, which inhibits U202 and limits the primary current flow in T101. After a short period of time, C106 will have charged to a -6.5 V dc. This voltage is applied through VR102 and cancels the positive voltage at the junction of R106 and R107. Diode CR105 reverse biases and Q206 inhibits. This enables U202, and normal operation is restored.

4.4.1.2 Modulator A3

4.4.1.2.1 General

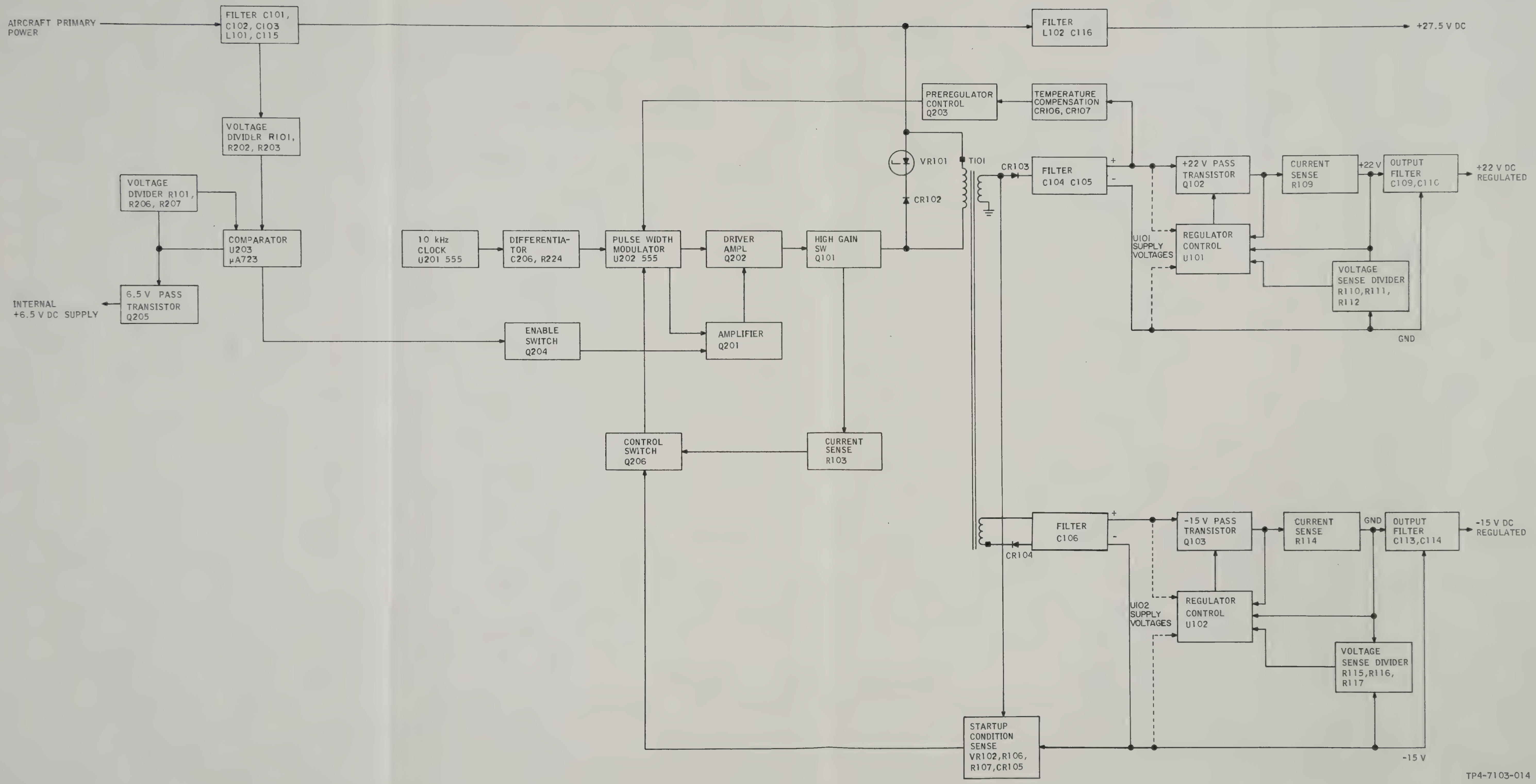
Modulator A3 consists of an oscillator circuit, an integrator driver circuit, an integrator circuit, and a transmitter current regulator circuit.

4.4.1.2.2 Oscillator Circuit (Refer to figure 4-6)

The oscillator circuit operates at either 100 or 105 Hz, depending on strapping in the aircraft interconnect wiring. Strapping rear connector P1-38 to the modulator frequency common (+22 V dc regulated) at P1-35 provides a 100-Hz modulator frequency, and strapping rear connector P1-40 to P1-35 provides a 105-Hz modulator frequency.

The oscillator operates at either a 0-degree phase or a 180-degree phase, depending on strapping in the aircraft interconnect wiring. Strapping rear connector P1-32 to modulator phase common (ground) at P1-30 provides a 0-degree modulation phase, and strapping rear connector P1-33 to P1-30 provides a 180-degree modulation phase. When dual systems are installed, one system should be strapped for a 100-Hz modulation frequency and a 0-degree modulation phase. The second system should be strapped for a 105-Hz modulation frequency and a 180-degree modulation phase. The described connection for a dual system eliminates the need of cross-connections between the two systems to prevent modulator signal interaction in the altimeter system. The theory of operation is discussed with a 100-Hz modulation frequency and a 0-degree modulation phase selected.

The regulated +22-V dc modulator frequency common is applied from P1-35 through P1-38 to R37 when a 100-Hz modulation signal is required or through P1-40 to R38 when a 105-Hz modulation signal is required. Operational amplifier U5 operates as an active bandpass filter with R37 or R38 determining the resonant frequency of the filter. When R37 is connected to the modulation frequency common, the resonant frequency of the filter is a nominal 100 Hz; and when R38 is connected to the modulation frequency common, the resonant frequency of the filter is a nominal 105 Hz. Transistor Q8 provides feedback to the bandpass filter input to maintain the oscillator operation. The active bandpass filter passes the nominal 100- or 105-Hz portion of the feedback signal and produces a 100-Hz sine wave through C24 to Q8. On initial startup, the active bandpass filter passes the 100- or 105-Hz harmonic of the initial spurious input to the filter.


AIRCRAFT PRIMARY POWER
FILTER C101, C102, C103 L101, C115
FILTER L102 C116
+27.5 V DC
PREREGULATOR CONTROL Q203
TEMPERATURE COMPENSATION CR106, CR107
VOLTAGE DIVIDER R101, R202, R203
VOLTAGE DIVIDER R101, R206, R207
VR101
CR102
T101
CR103
FILTER C104 C105
+
-
+22 V PASS TRANSISTOR Q102
CURRENT SENSE R109
+22 V
OUTPUT FILTER C109, C110
+22 V DC REGULATED
COMPARATOR U203 µA723
10 kHz CLOCK U201 555
DIFFERENTIATOR C206, R224
PULSE WIDTH MODULATOR U202 555
DRIVER AMPL Q202
HIGH GAIN SW Q101
U101 SUPPLY VOLTAGES
REGULATOR CONTROL U101
VOLTAGE SENSE DIVIDER R110, R111, R112
INTERNAL +6.5 V DC SUPPLY
6.5 V PASS TRANSISTOR Q205
ENABLE SWITCH Q204
AMPLIFIER Q201
GND
CONTROL SWITCH Q206
CURRENT SENSE R103
FILTER C106
+
-
CR104
-15 V PASS TRANSISTOR Q103
CURRENT SENSE R114
GND
OUTPUT FILTER C113, C114
-15 V DC REGULATED
U102 SUPPLY VOLTAGES
REGULATOR CONTROL U102
VOLTAGE SENSE DIVIDER R115, R116, R117
STARTUP CONDITION SENSE VR102, R106, R107, CR105
-15 V
TP4-7103-014

Power Supply A6, Block Diagram
Figure 4-5

C105 to regulator control U101 and pass transistor Q102. Regulator control U101 provides a control voltage that is applied to the base of Q102, and the current flow through pass transistor Q102 is controlled to produce the regulated +22.000-V dc output.

Resistor R109 connected between U101 pins 10 and 1 provides current sensing for the +22-V dc output, and C109 and C110 provide output filtering. Regulated +22 V dc is applied through voltage divider R110, R111, and R112 to U101-2 as an inverting voltage sensing input. Potentiometer R111 is adjusted to set the output of Q102 at +22.000 V dc. The regulated +22 V dc is also applied to rear connector P1-35 (modulator frequency common), to rear connector P1-49, and to the internal ALT-50A circuits.

The output from secondary pins 3 and 4 of T101 is applied through rectifier CR104 and filter capacitor C106 to regulator control U102 and pass transistor Q103. Regulator control U102 provides a control voltage that is applied to the base of Q103, and the current flow through pass transistor Q103 is controlled to produce the regulated -15.000-V dc output.

Resistor R114 connected between U102 pins 10 and 1 provides current sensing for the -15-V dc output, and C113 and C114 provide output filtering. Regulated -15 V dc is applied through voltage divider R115, R116, and R117 to U102-2 as an inverting voltage sensing input. Potentiometer R116 is adjusted to set the output of Q103 at -15.000 V dc. Regulated -15 V dc is also applied to rear connector P1-51 and to the internal ALT-50A circuits.

During initial startup, current flow through the primary of T101 is controlled by a startup condition sense circuit consisting of CR105, R106, R107, and VR102. As soon as +28 V dc power is applied, the junction of R106 and R107 becomes approximately +6.5 V dc. This forward biases CR105 and turns on Q206, which inhibits U202 and limits the primary current flow in T101. After a short period of time, C106 will have charged to a -6.5 V dc. This voltage is applied through VR102 and cancels the positive voltage at the junction of R106 and R107. Diode CR105 reverse biases and Q206 inhibits. This enables U202, and normal operation is restored.

4.4.1.2 Modulator A3

4.4.1.2.1 General

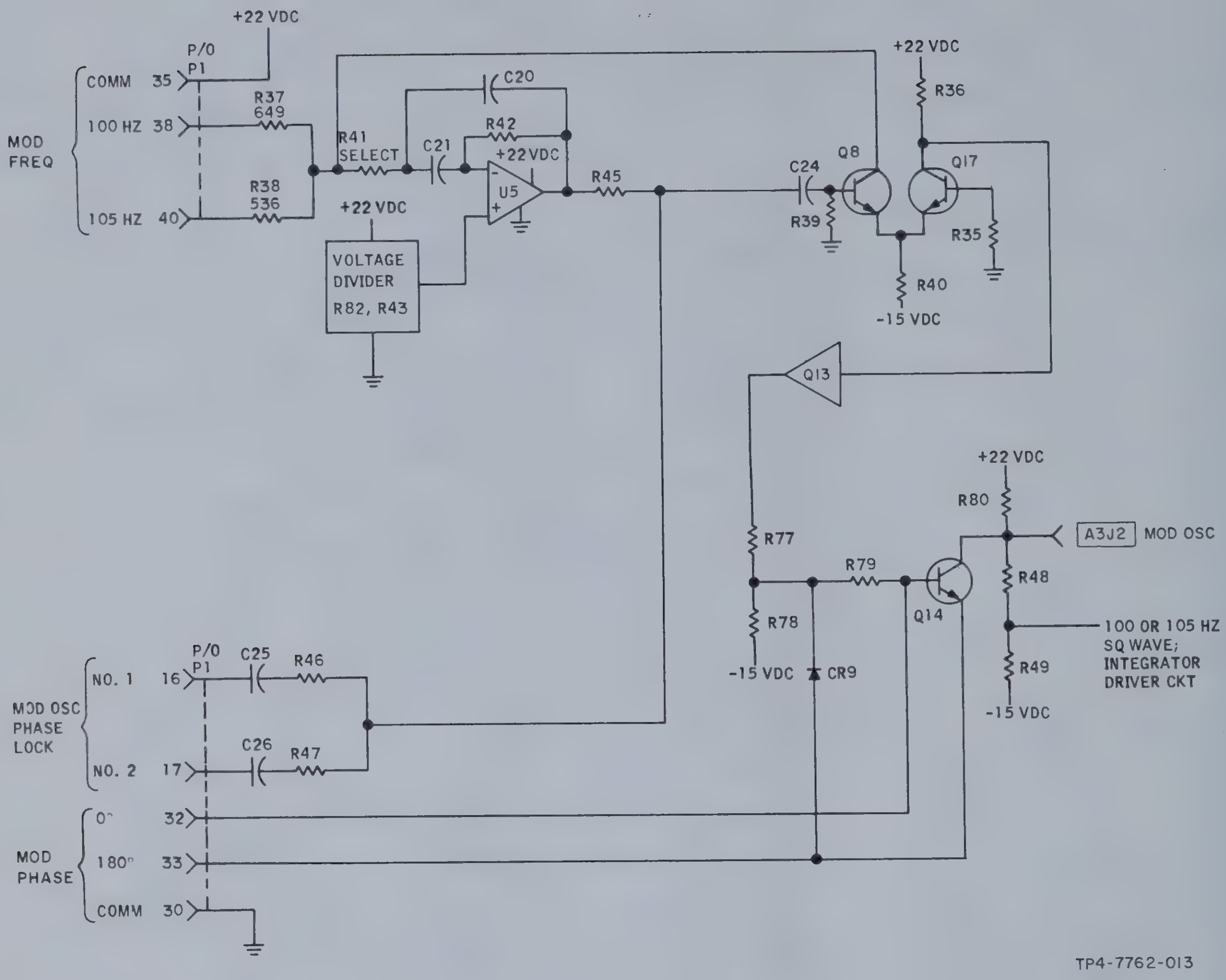
Modulator A3 consists of an oscillator circuit, an integrator driver circuit, an integrator circuit, and a transmitter current regulator circuit.

4.4.1.2.2 Oscillator Circuit (Refer to figure 4-6)

The oscillator circuit operates at either 100 or 105 Hz, depending on strapping in the aircraft interconnect wiring. Strapping rear connector P1-38 to the modulator frequency common (+22 V dc regulated) at P1-35 provides a 100-Hz modulator frequency, and strapping rear connector P1-40 to P1-35 provides a 105-Hz modulator frequency.

The oscillator operates at either a 0-degree phase or a 180-degree phase, depending on strapping in the aircraft interconnect wiring. Strapping rear connector P1-32 to modulator phase common (ground) at P1-30 provides a 0-degree modulation phase, and strapping rear connector P1-33 to P1-30 provides a 180-degree modulation phase. When dual systems are installed, one system should be strapped for a 100-Hz modulation frequency and a 0-degree modulation phase. The second system should be strapped for a 105-Hz modulation frequency and a 180-degree modulation phase. The described connection for a dual system eliminates the need of cross-connections between the two systems to prevent modulator signal interaction in the altimeter system. The theory of operation is discussed with a 100-Hz modulation frequency and a 0-degree modulation phase selected.

The regulated +22-V dc modulator frequency common is applied from P1-35 through P1-38 to R37 when a 100-Hz modulation signal is required or through P1-40 to R38 when a 105-Hz modulation signal is required. Operational amplifier U5 operates as an active bandpass filter with R37 or R38 determining the resonant frequency of the filter. When R37 is connected to the modulation frequency common, the resonant frequency of the filter is a nominal 100 Hz; and when R38 is connected to the modulation frequency common, the resonant frequency of the filter is a nominal 105 Hz. Transistor Q8 provides feedback to the bandpass filter input to maintain the oscillator operation. The active bandpass filter passes the nominal 100- or 105-Hz portion of the feedback signal and produces a 100-Hz sine wave through C24 to Q8. On initial startup, the active bandpass filter passes the 100- or 105-Hz harmonic of the initial spurious input to the filter.


+22 VDC
P/O
P1
COMM 35
100 HZ 38
105 HZ 40
MOD FREQ
R37
649
R38
536
R41
SELECT
C20
R42
C21
+22 VDC
U5
+22 VDC
VOLTAGE DIVIDER
R82, R43
R45
+22 VDC
R36
C24
Q8
Q17
R39
R35
R40
-15 VDC
Q13
+22 VDC
R80
A3J2
MOD OSC
R77
R79
R48
Q14
R78
-15 VDC
CR9
100 OR 105 HZ
SQ WAVE;
INTEGRATOR
DRIVER CKT
R49
-15 VDC
P/O
P1
C25
R46
NO. 1 16
MOD OSC PHASE LOCK
NO. 2 17
C26
R47
0° 32
MOD PHASE
180° 33
COMM 30
TP4-7762-013

P/O Modulator A3, Modulation Oscillator Circuit, Functional Diagram
Figure 4-6

The switching of Q17 and Q8 causes Q17 to produce a square wave that is applied to Q13. Transistor Q13 amplifies the square wave and applies the 100- or 105-Hz square wave through voltage divider R77, R78, through resistor R79 to the base of Q14, and through CR9 to the emitter of Q14.

The modulator phase common (ground) is applied from P1-30 through P1-32 to the base of Q14. With the base of Q14 grounded, Q14 operates as a common-base transistor, and the output of Q14 is in phase with the 100- or 105-Hz square wave applied to the emitter. The square wave is present at test jack A3J2 and is applied through voltage divider R80, R48, and R49 to the integrator driver circuit. When a 180-degree modulation phase is selected, a ground is applied to the emitter of Q14; and Q14 operates as a common-emitter transistor with the output 180 degrees out of phase in relation to the 100- or 105-Hz square wave applied to the base.

The modulation oscillator phase-lock network consists of C25, C26, R46, and R47. The phase-lock network is reserved for possible future use in multiple-system installations.

4.4.1.2.3 Integrator Driver and Integrator (Refer to figure 4-7)

The 100-Hz modulation square wave from the oscillator is applied to Q9 and Q10. Transistor Q9 switches with each positive portion of the duty cycle and Q10 with each negative portion. Transistors Q9 and Q10 apply a ground to R52 and R53 alternately at the 100-Hz rate. The ground applied to R52 causes Q11 to be forward biased by the positive deviation voltage from modulator control A4, and the ground applied to R53 causes Q12 to be forward biased by the negative deviation voltage from modulator control A4. Transistors Q11 and Q12 apply a 100-Hz square wave with an amplitude equal to the deviation voltages through R54 and C27 to the inverting input of U6. The amplitude of the deviation voltages determines the amplitude of the modulation signal applied to the transmitter and changes as required to maintain the transmitter deviation at 4250 to 4350 MHz.

A dc reference voltage from voltage divider R60, R61, R62 is applied through R59 to the noninverting input of U6. The reference voltage is adjusted by R61 to provide a dc voltage that corresponds to a 4300-MHz center frequency. Capacitor C37 removes noise from the reference voltage.

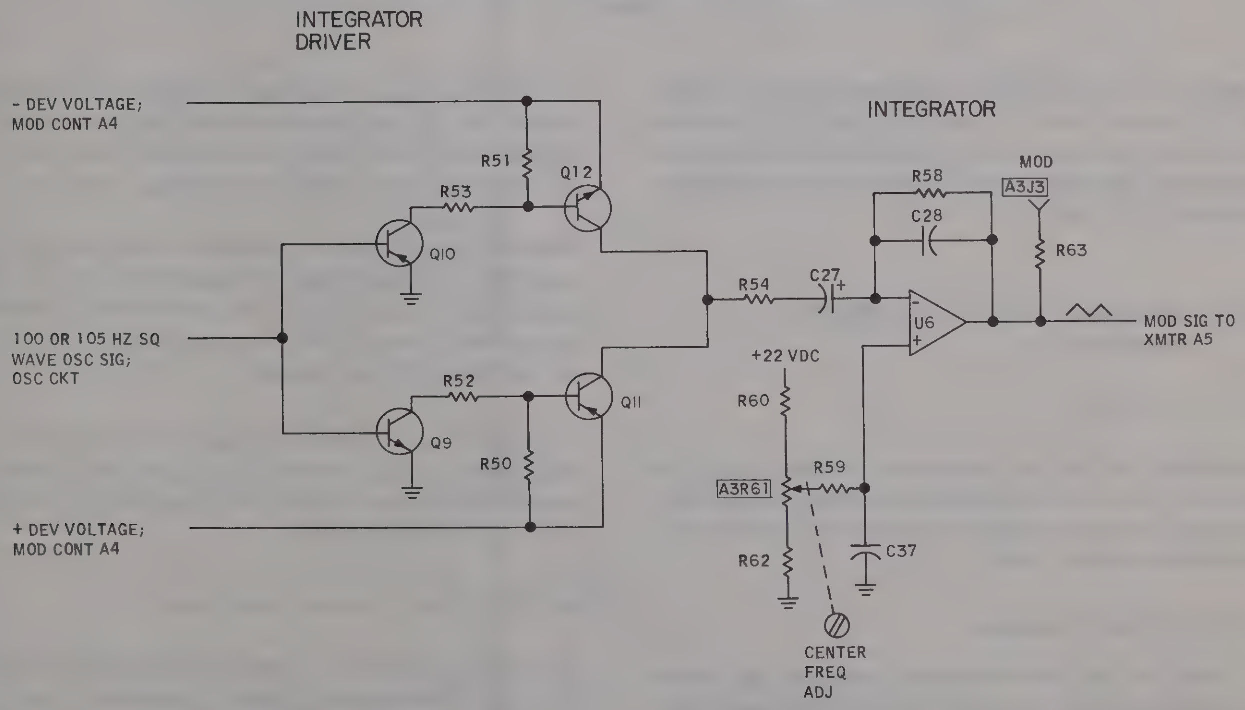
Operational amplifier U6 operates as an integrator and converts the 100-Hz square wave input to a 100-Hz triangular wave. The dc reference voltage adjusts the reference level of the triangular wave. The triangular wave, or modulation signal, is applied to transmitter A5 and through R63 to test point J3.

4.4.1.2.4 Transmitter Current Regulator (Refer to figure 4-8)

The +22-V dc current path from the power amplifier circuit on transmitter A5 is through R68 and L1 to the +22-V dc supply voltage line. When the power amplifier current increases, the voltage drop across R68 increases and the forward bias to Q16 decreases. The collector current of Q16 decreases, and the base current of the power amplifier in A5 decreases. When the power amplifier current decreases, the regulator reacts in the opposite direction to maintain the collector current at the proper level.

The +22-V dc current path from the oscillator circuit on transmitter A5 is through R73, R71, Q15, R67, and L1 to the +22-V dc supply voltage line. The current changes vary the voltage drop across R67 and the forward bias to Q15. The circuit operates the same as described for the power amplifier and provides correct current regulation to the oscillator circuit on transmitter A5.

Inductor L1 and capacitor C35 filter and isolate the voltage supply from the +22-V dc supply voltage.



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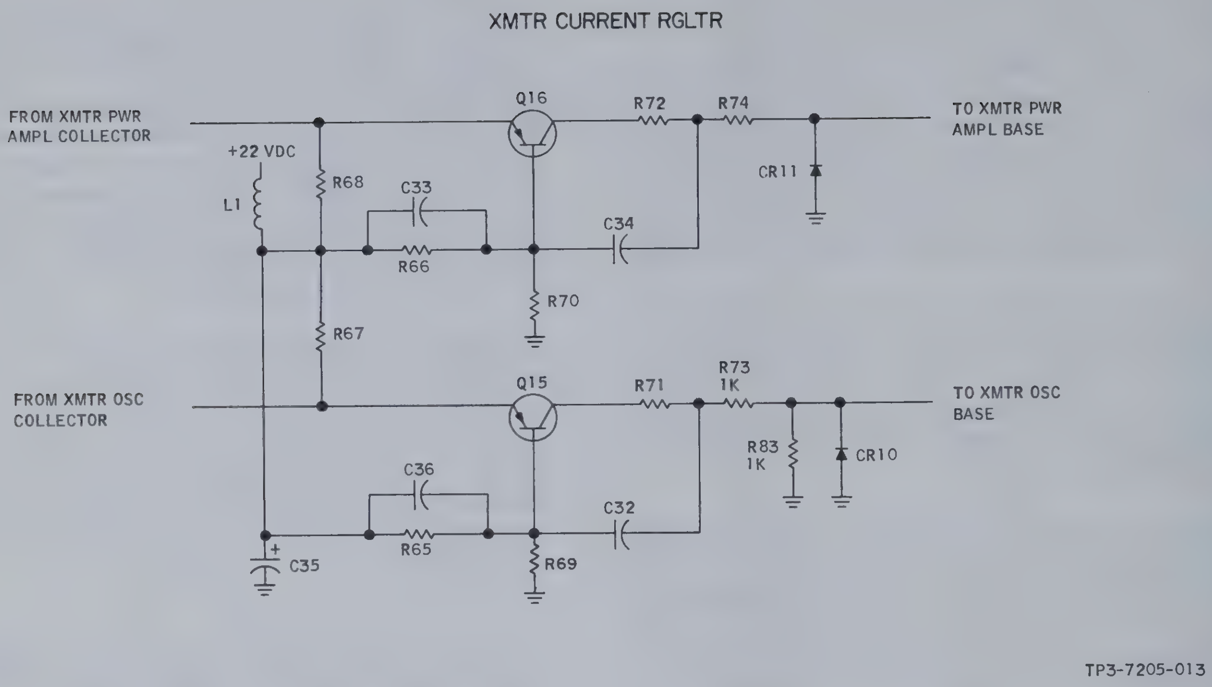
P/O Modulator A3, Integrator/Driver Circuit, Simplified Schematic Diagram
Figure 4-7



P/O Modulator A3, Transmitter Current Regulator Circuit, Simplifed Schematic Diagram
Figure 4-8

Capacitors C33 and C36 provide fast response of Q16 and Q15 respectively. Diodes CR10 and CR11 prevent the voltage applied to the transmitter oscillator and power amplifier from becoming more negative than a nominal -0.6 V dc.

4.4.1.3 Modulator Control A4 (Refer to figure 4-9)

4.4.1.3.1 General

Modulator control A4 consists of a filter/amplifier circuit, a zero-crossing detector circuit, a frequency-to-voltage converter circuit, an inverter, and a wobbulation generator circuit.

4.4.1.3.2 Filter/Amplifier

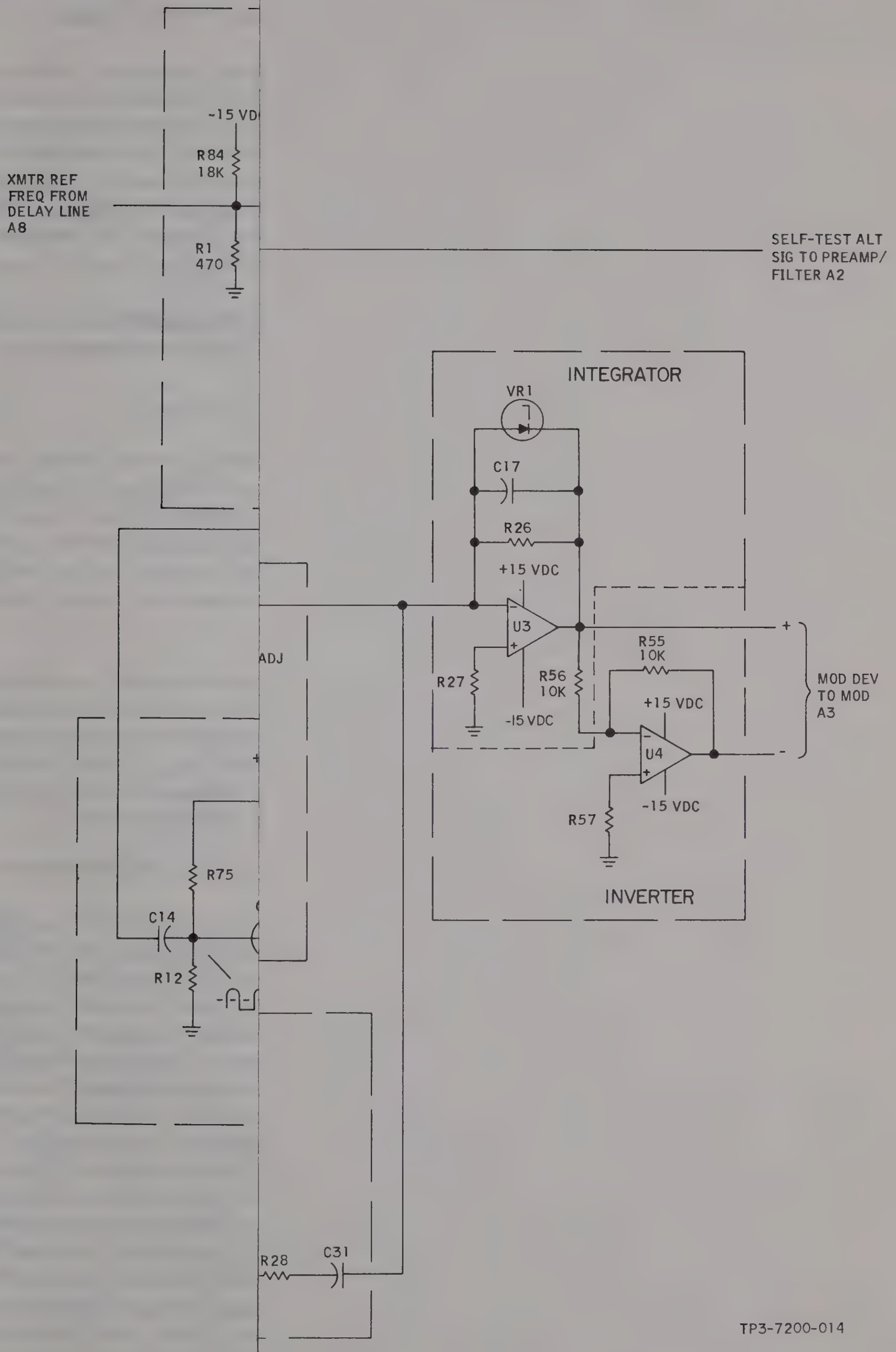
The nominal self-test reference frequency sine wave from delay line A8 is applied through low-pass filter C1 and R83 to the inverting input of U1. Operational amplifier U1 operates as an active high-pass filter. The gain of U1 is established by the feedback through R3 in relation to the source impedance. A nominal +11-V dc reference voltage is applied from voltage divider R4, R5 to the noninverting input of U1. The output of U1 is applied through high-pass filter C8, R7, and capacitor C9 to the inverting input of U2.

Operational amplifier U2 operates as an active high-pass filter and functions in the same way as U1. The output of U2 is applied to the zero-crossing detector circuit and through R64 to preamplifier/filter A2 as the self-test altitude signal.

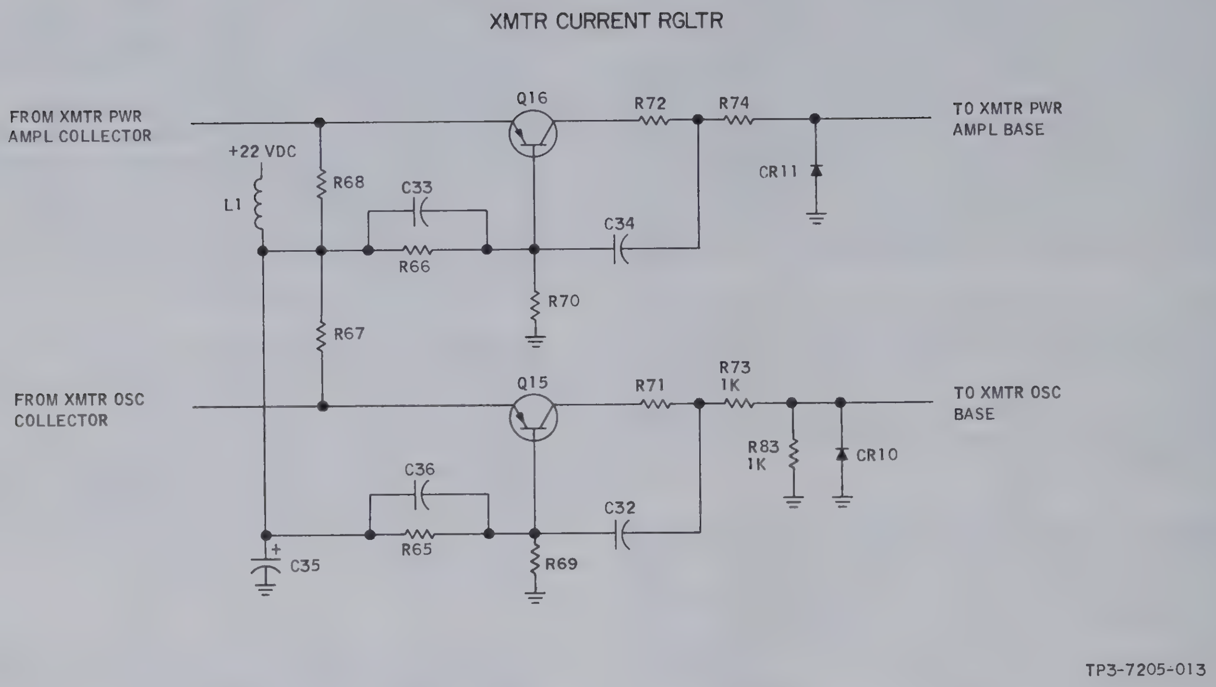
Voltage divider R1, R84 provides forward bias for the mixer diode in transmitter A5. Capacitors C5 and C11 remove noise from the dc reference voltages applied to U1 and U2 respectively.

4.4.1.3.3 Zero-Crossing Detector

The output of the filter/amplifier is applied through C14 to Q1. Transistors Q1 and Q2 operate as a voltage comparator. Transistor Q1 turns on with each positive trigger pulse and Q2 turns off. The square-wave output is applied through inverting amplifier Q3 to differentiator C15, R22, CR1. The differentiator


-15 VD
R84
18K
XMTR REF
FREQ FROM
DELAY LINE
A8
R1
470
SELF-TEST ALT
SIG TO PREAMP/
FILTER A2
INTEGRATOR
VR1
C17
R26
+15 VDC
U3
R27
R56
10K
-15 VDC
R55
10K
+15 VDC
U4
R57
-15 VDC
+
-
MOD DEV
TO MOD
A3
INVERTER
ADJ
+
R75
C14
R12
R28
C31
TP3-7200-014

Modulator Control A4, Functional Diagram
Figure 4-9



P/O Modulator A3, Transmitter Current Regulator Circuit, Simplifed Schematic Diagram
Figure 4-8

Capacitors C33 and C36 provide fast response of Q16 and Q15 respectively. Diodes CR10 and CR11 prevent the voltage applied to the transmitter oscillator and power amplifier from becoming more negative than a nominal -0.6 V dc.

4.4.1.3 Modulator Control A4 (Refer to figure 4-9)

4.4.1.3.1 General

Modulator control A4 consists of a filter/amplifier circuit, a zero-crossing detector circuit, a frequency-to-voltage converter circuit, an inverter, and a wobbulation generator circuit.

4.4.1.3.2 Filter/Amplifier

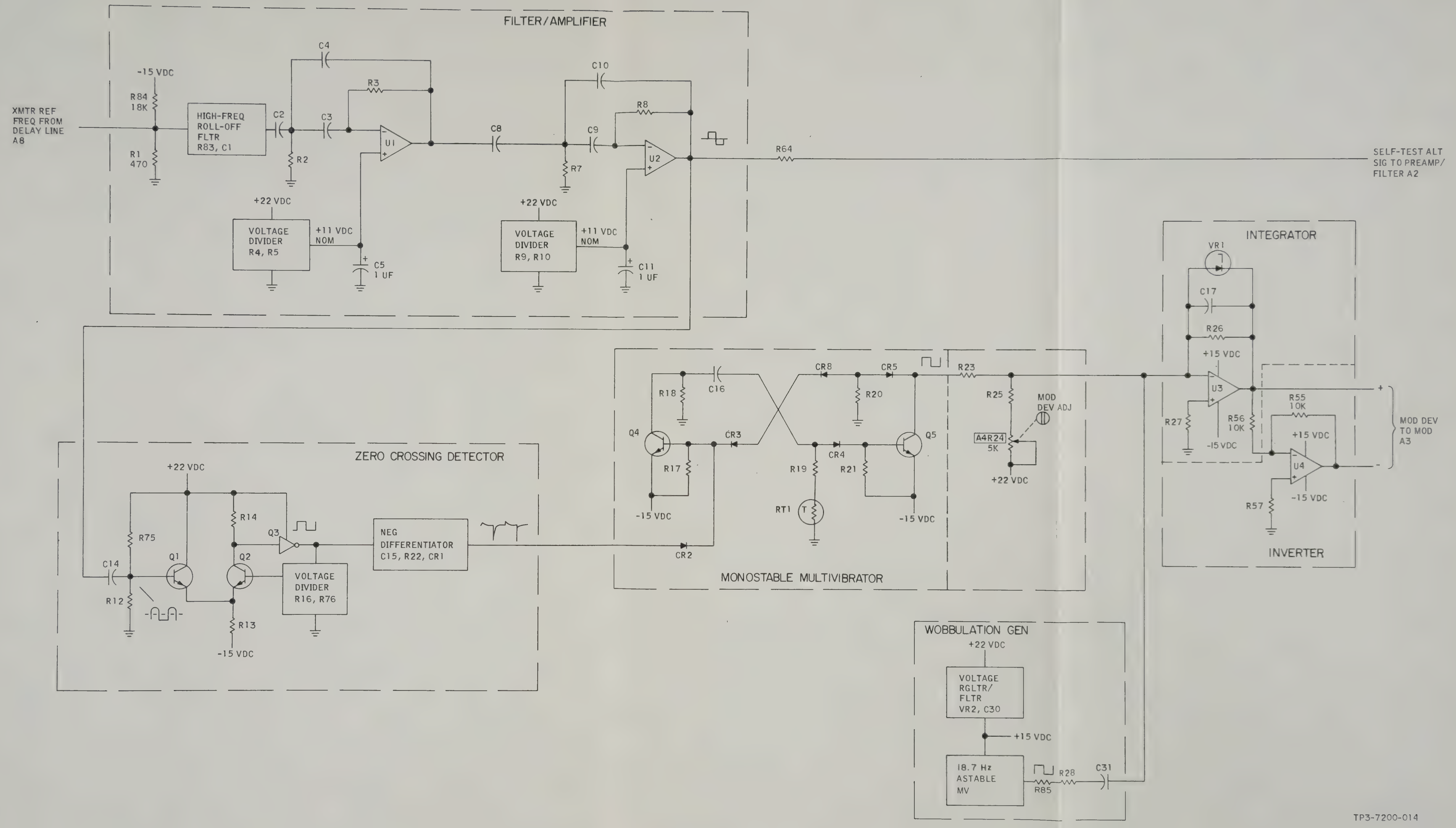
The nominal self-test reference frequency sine wave from delay line A8 is applied through low-pass filter C1 and R83 to the inverting input of U1. Operational amplifier U1 operates as an active high-pass filter. The gain of U1 is established by the feedback through R3 in relation to the source impedance. A nominal +11-V dc reference voltage is applied from voltage divider R4, R5 to the noninverting input of U1. The output of U1 is applied through high-pass filter C8, R7, and capacitor C9 to the inverting input of U2.

Operational amplifier U2 operates as an active high-pass filter and functions in the same way as U1. The output of U2 is applied to the zero-crossing detector circuit and through R64 to preamplifier/filter A2 as the self-test altitude signal.

Voltage divider R1, R84 provides forward bias for the mixer diode in transmitter A5. Capacitors C5 and C11 remove noise from the dc reference voltages applied to U1 and U2 respectively.

4.4.1.3.3 Zero-Crossing Detector

The output of the filter/amplifier is applied through C14 to Q1. Transistors Q1 and Q2 operate as a voltage comparator. Transistor Q1 turns on with each positive trigger pulse and Q2 turns off. The square-wave output is applied through inverting amplifier Q3 to differentiator C15, R22, CR1. The differentiator


FILTER/AMPLIFIER
XMTR REF FREQ FROM DELAY LINE A8
-15 VDC
R84 18K
R1 470
HIGH-FREQ ROLL-OFF FLTR R83, C1
C2
R2
C4
R3
C3
U1
+22 VDC
VOLTAGE DIVIDER R4, R5
+11 VDC NOM
C5 1 UF
C8
C10
R8
C9
R7
U2
+22 VDC
VOLTAGE DIVIDER R9, R10
+11 VDC NOM
C11 1 UF
R64
SELF-TEST ALT SIG TO PREAMP/ FILTER A2
INTEGRATOR
VR1
C17
R26
+15 VDC
U3
R27
R56 10K
-15 VDC
R55 10K
+15 VDC
U4
R57
-15 VDC
INVERTER
MOD DEV TO MOD A3
+
-
ZERO CROSSING DETECTOR
+22 VDC
R75
R14
Q3
C14
Q1
Q2
VOLTAGE DIVIDER R16, R76
R12
R13
-15 VDC
NEG DIFFERENTIATOR C15, R22, CR1
CR2
Q4
R18
C16
CR3
R17
-15 VDC
CR8
CR5
R20
CR4
R19
R21
Q5
RT1
T
-15 VDC
MONOSTABLE MULTIVIBRATOR
R23
R25
MOD DEV ADJ
A4R24 5K
+22 VDC
WOBBULATION GEN
+22 VDC
VOLTAGE RGLTR/ FLTR VR2, C30
+15 VDC
18.7 Hz ASTABLE MV
R28
R85
C31
TP3-7200-014

Modulator Control A4, Functional Diagram
Figure 4-9

clips the negative portion of the square wave and produces positive-going trigger pulses to trigger the monostable multivibrator Q4, Q5 through CR2.

4.4.1.3.4 Monostable Multivibrator

The positive-going trigger pulses from the zero-crossing detector are applied through CR2 to Q4. Transistors Q4 and Q5 operate as a monostable multivibrator. The discharge time of C16 is constant and maintains the positive portion of the duty cycle from Q5 at a constant width. The width of the negative portion varies with the trigger pulse frequency applied to the base of Q4. When the trigger pulse frequency decreases, indicating that the deviation is less than a nominal 100 MHz, the negative portion of the duty cycle increases, causing the average dc level of the waveform to decrease. When the trigger pulse frequency increases, indicating that the deviation is greater than a nominal 100 MHz, the average dc level of the waveform increases.

4.4.1.3.5 Wobbulation Generator

The wobbulation generator consists of a voltage regulator/filter and an astable multivibrator. The voltage regulator/filter produces the +15-V dc bias voltage that is used in the wobbulation generator and modulation deviation amplifier circuits. The multivibrator produces a square wave that is applied through R28, R85, and coupling capacitor C31 to the integrator.

4.4.1.3.6 Integrator and Inverter

The square or rectangular wave from the frequency-to-voltage converter is combined with the output from the wobbulation generator. The wobbulation square wave added to the square or rectangular wave from the converter prevents step changes in the modulator deviation control voltages when an increase or decrease is required to correct the transmitter deviation. The two signals are applied to the inverting input of U3. Operational amplifier U3 operates as an integrator. Capacitor C17 provides a long time constant so that U3 produces a dc output which increases with the frequency of the Q5 collector slave form with a wobbulation signal superimposed. VR1 limits this to 10 volts. The positive dc output of U3 is applied to modulator A3 as the positive modulator deviation control voltage and through R56 to inverter U4.

Operational amplifier U4 operates as a unity gain inverting amplifier and produces a negative dc voltage that is applied to modulator A3 as the negative modulator control voltage.

When the transmitter reference frequency input to modulator control A4 is correct, the transmitter deviation is a nominal 4250 to 4350 MHz, U3 applies a nominal +6-V dc modulator control voltage to modulator A3, and U4 applies a nominal -6-V dc modulator control voltage. The modulator control voltages change as required to maintain the transmitter deviation at the correct value.

4.4.1.4 Transmitter A5 and Delay Line A8
(Refer to figure 4-10)

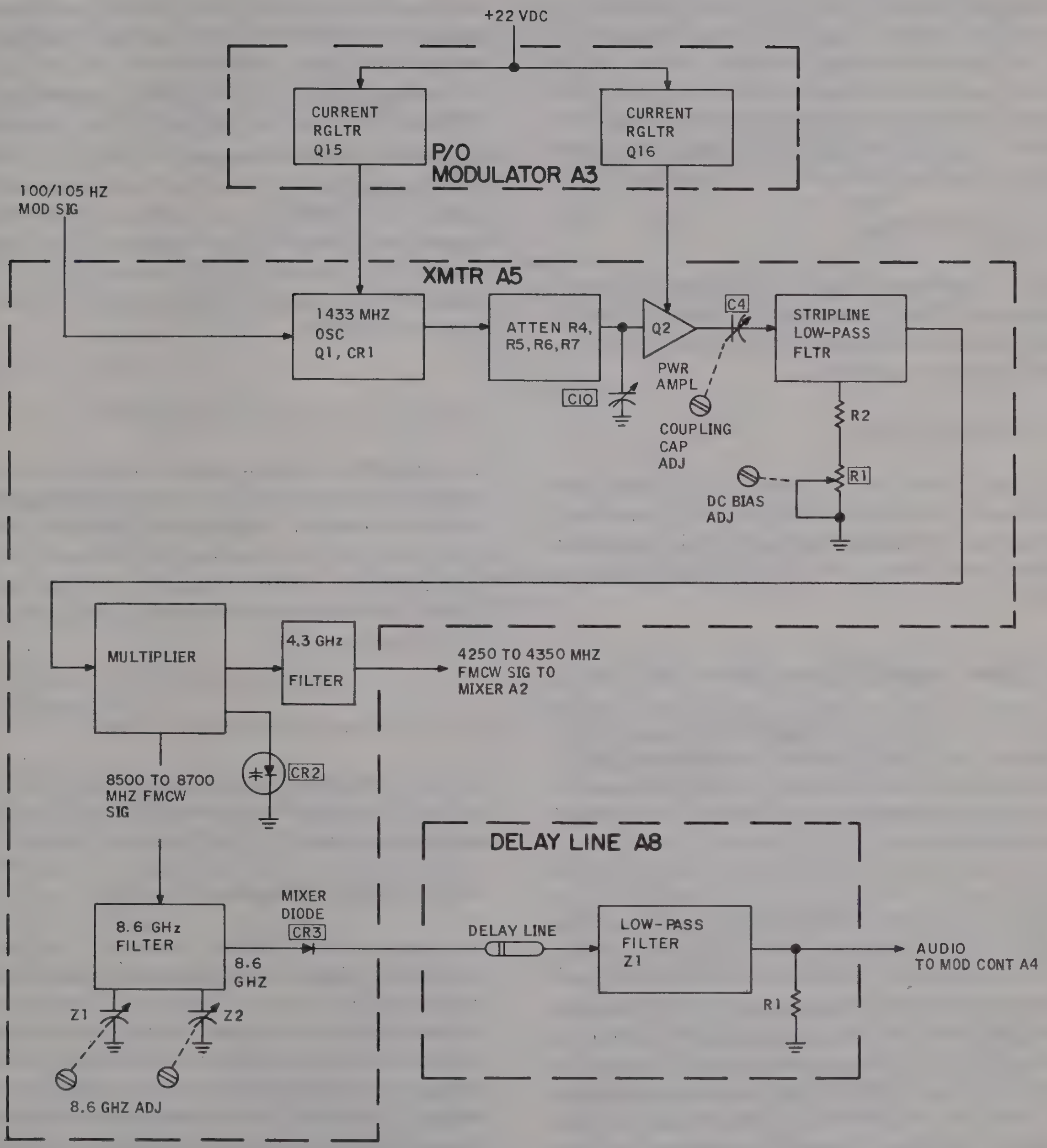
4.4.1.4.1 General

Transmitter A5 and delay line A8 are discussed together to provide the theory of operation for the self-test altitude signal. Transmitter A5 consists of a 1433-MHz oscillator circuit, a power amplifier circuit, a multiplier circuit, a filter, and a mixer diode. Delay line A8 consists of a delay line and a low-pass filter circuit.

Either a 100- or 105-Hz modulator signal can be used to modulate the oscillator, depending on strapping in the aircraft wiring harness. During this discussion, it is assumed that a 100-Hz modulation signal is used. Transmissions of the signal through the transmitter circuits is by strip line.

4.4.1.4.2 1433-MHz Oscillator

The triangular, 100-Hz modulation signal from modulator A3 is applied through strip line and L1 to varactor CR1. Transistor Q1, capacitor C1, and varactor CR1 form a tuned frequency oscillator circuit with the feedback signal supplied by the Q1 emitter inductance. The dc reference level of the modulator signal, which is adjusted by A3R61, controls the dc bias applied to CR1 and sets the center frequency of the oscillator. The triangular wave applied to CR1 causes the capacitance to increase and decrease and decreases and increases the oscillator frequency. The nominal 100-Hz modulation signal causes the oscillator to produce a nominal 1416.7- to 1450.0-MHz signal that is applied through coupling capacitor C2, attenuation network R4, R5, R6, and R7, and coupling capacitor C3 to the power amplifier circuit. The attenuation network provides isolation between the oscillator and power amplifier circuits. Rf chokes L1 and L2 prevent radio frequencies from being applied to the modulator and transmitter current regulator circuits.


+22 VDC
CURRENT RGLTR Q15
CURRENT RGLTR Q16
P/O MODULATOR A3
100/105 HZ MOD SIG
XMTR A5
1433 MHZ OSC Q1, CR1
ATTEN R4, R5, R6, R7
Q2
PWR AMPL
C10
C4
COUPLING CAP ADJ
STRIPLINE LOW-PASS FLTR
R2
R1
DC BIAS ADJ
MULTIPLIER
4.3 GHz FILTER
4250 TO 4350 MHZ FMCW SIG TO MIXER A2
CR2
8500 TO 8700 MHZ FMCW SIG
DELAY LINE A8
8.6 GHz FILTER
MIXER DIODE CR3
8.6 GHZ
DELAY LINE
LOW-PASS FILTER Z1
AUDIO TO MOD CONT A4
R1
Z1
Z2
8.6 GHZ ADJ

TP4-8009-014

Transmitter A5, Functional Diagram
Figure 4-10

4.4.1.4.3 Power Amplifier and Multiplier

The FM signal from the oscillator is applied to Q2. Capacitor C10 tunes the input of Q2 to provide a maximum output. Resistor R3 provides stabilization. Transistor Q2 increases the signal a nominal 10 dB and applies approximately 1 watt of signal through coupling capacitor C4 and strip line low-pass filter to the multiplier circuit. Capacitor C4 is adjusted to provide optimum coupling. Variable resistor R1 is adjusted to set the dc bias level of multiplier diode CR2. Both C4 and R1 are adjusted during transmitter alignment to provide maximum transmitter output with a flat response throughout the passband.

4.4.1.4.4 4.3-GHz Filter

The signal from the multiplier is applied to the 4.3-GHz band-pass filter. The strip line filter is tuned to pass only the third harmonic and applies a 4250- to 4350-MHz signal to mixer A7.

4.4.1.4.5 8.6-GHz Filter

The 8.6-GHz filter circuit consists of strip line resonators and tuning screws Z1 and Z2. The circuit is tuned to pass the sixth harmonic of the oscillator frequency and applies an 8.6-GHz FM signal to mixer diode CR3.

4.4.1.4.6 Mixer Diode CR3 and Delay Line A8

Mixer diode CR3 is part of transmitter A5 and works in conjunction with delay line A8 to produce an audio reference signal whose frequency is proportional to the deviation rate. Delay line A8 consists of a delay line and filter Z1.

The FM signal from transmitter A5 is applied through diode CR3 and the delay line to filter Z1. Filter Z1 acts as an rf short and reflects the signal back through the delay line to mixer diode CR3. During the time required for the reflected signal to return to CR3, the transmitter signal from the doubler circuit has changed. This causes mixer diode CR3 to produce an altitude reference signal. The audio signal is applied through the delay line and filter Z1 to modulator control A4 as the transmitter reference signal. The transmitter reference frequency increases and decreases when the transmitter deviation increases and decreases from the nominal 4250 to 4350 MHz.

4.4.1.5 Mixer A7 (Refer to figure 4-11)

4.4.1.5.1 General

Mixer A7 is a strip line mixer that consists of a transmit circulator circuit, a receive circulator circuit, and a mixer circuit. The discussion assumes that the transmit signal is 4305.000 MHz and the receive signal is 4304.999 MHz. The normal transmit signal sweeps from 4250 to 4350 MHz and the receive signal is a delayed 4250 to 4350 MHz, depending on the altitude above the terrain. For example, a transmitted 4300-MHz signal returns as a 4300-MHz receive signal but during the time required for the signal to travel to the terrain and back, the transmitter frequency has increased. The difference between the transmit and receive signal is the if signal whose frequency is proportional to the altitude above the terrain.

4.4.1.5.2 Transmit Circulator HY1

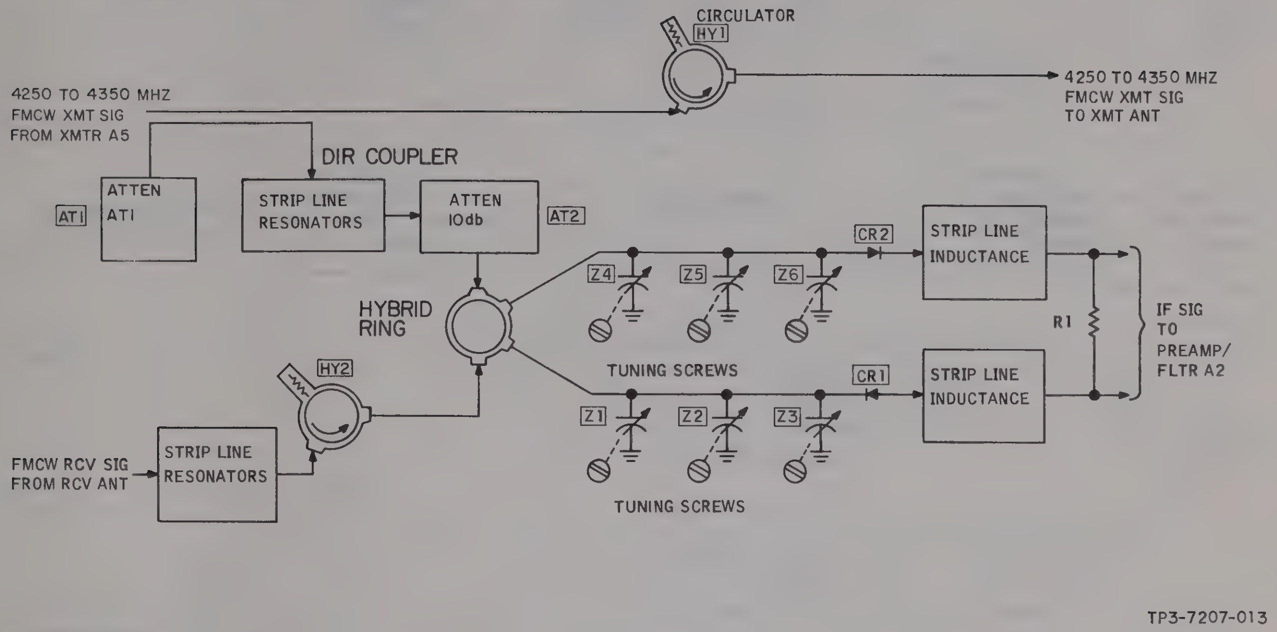
The 4305-MHz transmit signal from transmitter A5 is applied through HY1 to the transmit antenna. A directional coupler samples the 4305-MHz transmit signal and applies the sample through strip line resonators and 10-dB attenuator AT2 to the mixer circuit. The directional coupler is terminated with 50-ohm attenuator AT1.

4.4.1.5.3 Receive Circulator Circuit

The 4304.999-MHz receive signal from the receive antenna is applied through strip line resonators and receive circulator HY2 to the mixer circuit.

4.4.1.5.4 Mixer Circuit

The sample 4305-MHz transmit signal from attenuator AT2 in the transmit circuit and the 4304.999-MHz receive signal from the receive circulator circuit are applied to the hybrid ring. The hybrid ring applies equal amounts of the signals through strip line circuits with adjustable tuning screws Z1 through Z6 to mixer diodes CR1 and CR2. Mixer diodes CR1 and CR2 produce a 1-kHz if signal that is applied through strip line low-pass filter to preamplifier/filter A2. The 1000-Hz signal corresponds to a 25-foot altitude signal (aircraft installation delay is disregarded) using the if signal analog of 40 Hz per foot.


CIRCULATOR
HY1
4250 TO 4350 MHZ
FMCW XMT SIG
FROM XMTR A5
4250 TO 4350 MHZ
FMCW XMT SIG
TO XMT ANT
DIR COUPLER
AT1
ATTEN
AT1
STRIP LINE
RESONATORS
ATTEN
10db
AT2
CR2
STRIP LINE
INDUCTANCE
Z4
Z5
Z6
HYBRID
RING
R1
IF SIG
TO
PREAMP/
FLTR A2
HY2
TUNING SCREWS
CR1
STRIP LINE
INDUCTANCE
Z1
Z2
Z3
FMCW RCV SIG
FROM RCV ANT
STRIP LINE
RESONATORS
TUNING SCREWS
TP3-7207-013

Mixer A7, Functional Diagram
Figure 4-11

4.4.1.6 *Preamplifier/Filter A2 (Refer to figure 4-12)*

4.4.1.6.1 *General*

Preamplifier/filter A2 consists of a preamplifier circuit, a bandwidth control circuit, a low-pass filter circuit, a postamplifier circuit, a zero-crossing detector circuit, a signal presence detector circuit, and a self-test signal gate circuit.

4.4.1.6.2 *Preamplifier (Refer to figure 4-13)*

The sine-wave if signal from mixer A7 is applied through coupling capacitors C1 and C2, transformer T1, and low-frequency rolloff filter C3, R6 to transistor Q1. Resistive networks R1, R3, R19 and R2, R4, R71 provide the dc bias for the mixer diodes in mixer A7. Capacitors C28 and C29 remove noise from the mixer diode bias voltages.

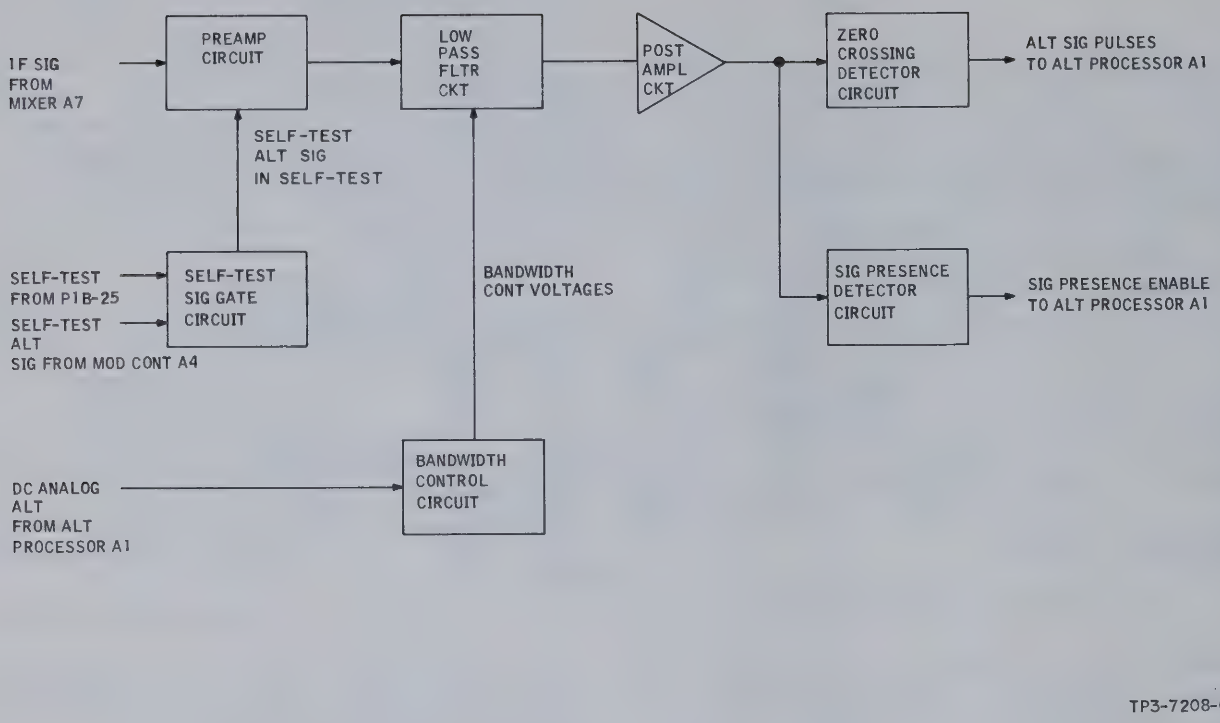
Transistors Q1 and Q2 are ac amplifiers that apply the amplified if signal through coupling capacitor C6 to Q3. Resistive network R5, R11, R12 provides the dc bias for Q1 and Q2, and capacitors C21, C7, and C4 provide noise filtration and isolation. Resistors R8 and R9 and capacitor C5 form a low-frequency rolloff filter in the emitter circuit of Q1.

Transistors Q3 and Q4 are ac amplifiers and apply the amplified if signal to the low-pass filter circuit. Resistive network R13, R14, R15, R16 provides the dc bias to Q3 and Q4, and capacitor C8 provides noise filtration. Resistors R17 and R95 and capacitor C9 form a low-frequency rolloff filter circuit of Q3.

When the ALT-50A is placed in the self-test mode, the self-test altitude signal from the self-test signal gate circuit is applied to Q1. The frequency of the self-test signal corresponds to an altitude of 50 feet.

4.4.1.6.3 *Bandwidth Control (Refer to figure 4-14)*

The dc analog altitude voltage from altitude processor A1 is applied through R72, R81, and R91 to Q20, Q36, and Q37 respectively. Transistors Q20/Q35, Q23/Q36, and Q37/Q24 operate as voltage comparators. Voltage dividers R70, R74; R84, R85; and

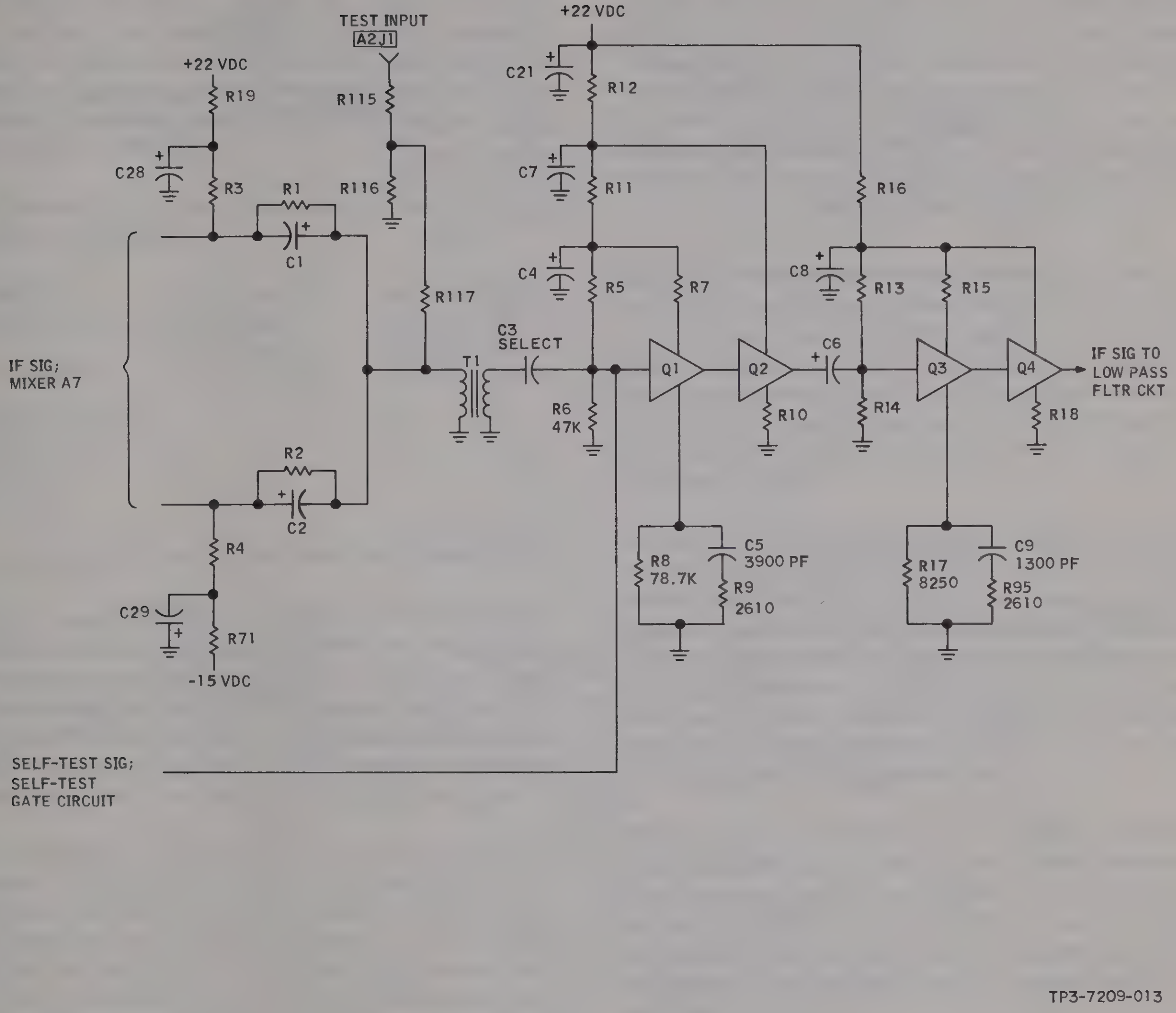

IF SIG
FROM
MIXER A7
PREAMP
CIRCUIT
LOW
PASS
FLTR
CKT
POST
AMPL
CKT
ZERO
CROSSING
DETECTOR
CIRCUIT
ALT SIG PULSES
TO ALT PROCESSOR A1
SELF-TEST
ALT SIG
IN SELF-TEST
SELF-TEST
FROM P1B-25
SELF-TEST
ALT
SIG FROM MOD CONT A4
SELF-TEST
SIG GATE
CIRCUIT
BANDWIDTH
CONT VOLTAGES
SIG PRESENCE
DETECTOR
CIRCUIT
SIG PRESENCE ENABLE
TO ALT PROCESSOR A1
DC ANALOG
ALT
FROM ALT
PROCESSOR A1
BANDWIDTH
CONTROL
CIRCUIT
TP3-7208-013

Preamplifier/Filter A2, Block Diagram
Figure 4-12

R86, R87 apply the reference voltages to Q35, Q23, and Q24 respectively. The reference voltages set Q37/Q24 to switch at a nominal 1,250 feet, Q23/Q36 to switch at a nominal 875 feet, and Q20/Q35 to switch at a nominal 275 feet.

When the aircraft is above a nominal 1,250 feet, the dc analog altitude voltage exceeds the reference voltages to Q35, Q23, and Q24. Transistor Q20 conducts and Q21 is turned off. Transistor Q36 conducts and Q22 is turned on. Transistor Q22 applies +22V dc through R78 to CR9, through R80 and CR14 to Q36, and through voltage divider R79, R95 to Q28. Transistor Q28 conducts and applies a ground to voltage divider R97, VR2, R139, causing a negative voltage to be applied to Q29. Transistor Q29 turns off and +22 V dc is applied through R98 and R119 to J3 and to the low-pass filter circuit as the bandwidth control no 2 voltage. Transistor Q37 conducts and turns on Q25. Transistor Q25 applies +22 V dc through voltage divider R92, R93 to Q26. Transistor Q26 conducts and applies a ground through VR1 to Q27. Transistor Q27 is turned off and +22 V dc is applied through R94 and R118 to J2 and to the low-pass filter circuit as the bandwidth control no 1 voltage. At altitudes above a nominal 1,250 feet, both bandwidth control no 1 and no 2 voltages are positive.

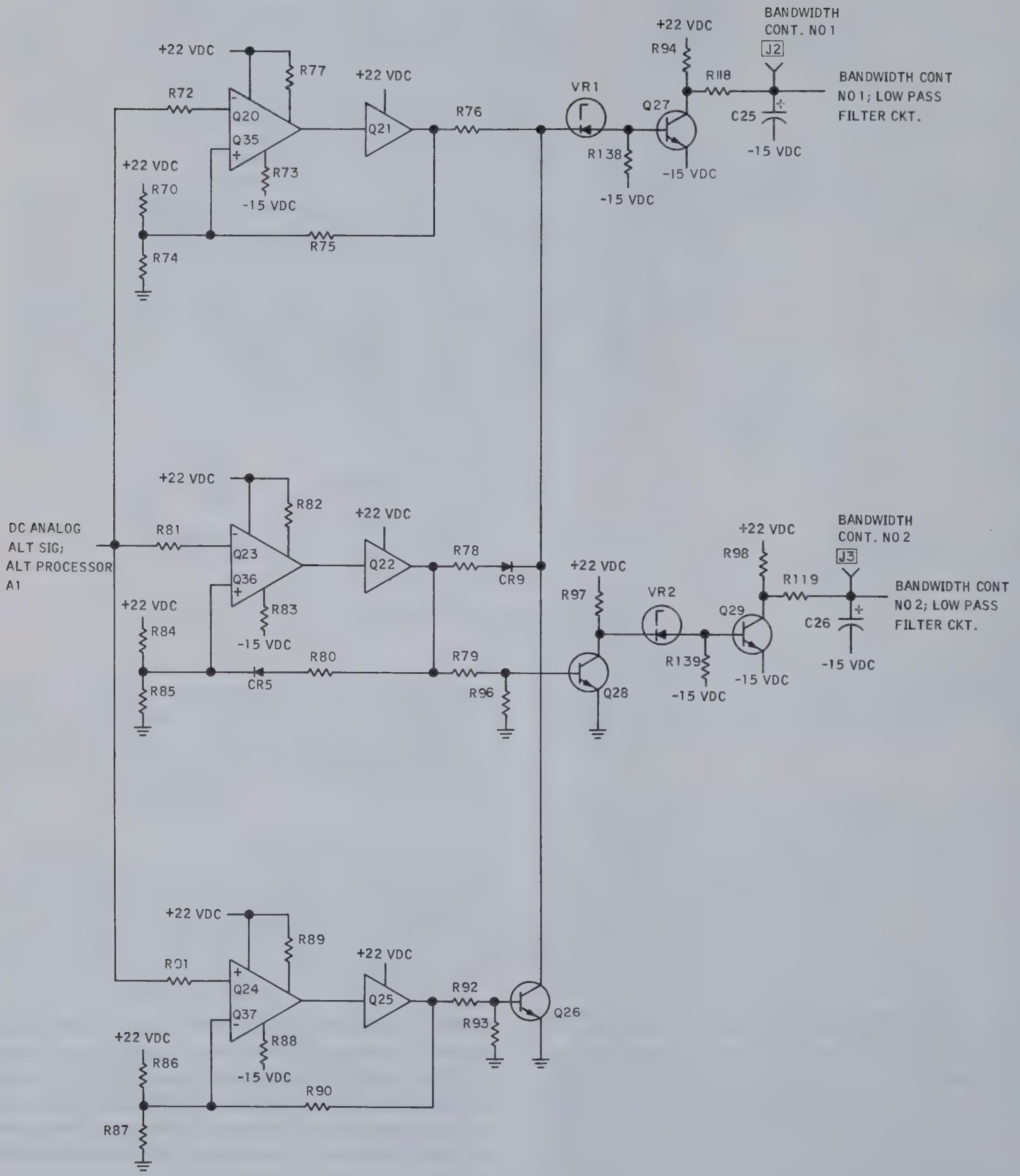
When the aircraft descends through a nominal 1,250 feet, the dc analog altitude voltage decrease causes Q24 to conduct and Q25 turns off. Transistor Q25 removes the forward bias applied to Q26 which turns off, removing the ground applied to CR9 and VR1. Transistor Q22 applies +22 V dc through voltage divider R79, R96 to Q28. Transistor Q28 conducts and applies a ground to VR2. Transistor Q29 is reverse biased and +22 V dc is applied through R98 and R119 to J3 and to the low-pass filter circuit as the bandwidth control no 2 voltage. The +22 V dc from Q22 is applied through R78, CR9, and VR1 to Q27. Transistor Q27 conducts and applies -15 V dc through R118 to J2 and to the low-pass filter circuit as the bandwidth control no 1 voltage. Resistor R90 provides hysteresis to ensure switching at an altitude above a nominal 1,250 feet during climbout. At a nominal 1,250 feet, the bandwidth control no 1 voltage is negative and the bandwidth control no 2 voltage is positive.


TEST INPUT
A2J1
+22 VDC
+22 VDC
R19
R115
C21
R12
C28
R3
R1
R116
C7
R11
R16
C1
C4
R5
R7
C8
R13
R15
R117
C3
SELECT
C6
IF SIG;
MIXER A7
T1
Q1
Q2
Q3
Q4
IF SIG TO
LOW PASS
FLTR CKT
R6
47K
R10
R14
R18
R2
C2
R4
R8
78.7K
C5
3900 PF
R9
2610
R17
8250
C9
1300 PF
R95
2610
C29
R71
-15 VDC
SELF-TEST SIG;
SELF-TEST
GATE CIRCUIT
TP3-7209-013

P/O Preamplifier/Filter A2, Preamplifier Circuit, Functional Diagram
Figure 4-13

When the aircraft descends through a nominal 875 feet, the dc analog altitude voltage decrease causes Q23 to conduct and Q22 turns off. Transistor Q22 removes the positive voltage applied through R78, CR9, and VR1 to Q27 and through voltage divider R79, R96 to Q28. Transistor Q27 turns off and +22 V dc is applied through R94 and R118 to J2 and to the low-pass filter circuit as the bandwidth control no 1 voltage. Transistor Q28 turns off and +22 V dc is applied through voltage divider R97, VR2, R139 to Q29. Transistor Q29 conducts and applies -15 V dc through R119 to J3 and to the low-pass filter circuit as the bandwidth control no 2 voltage. At a nominal 875 feet, the bandwidth control no 1 voltage becomes positive and the bandwidth control no 2 voltage becomes negative. Resistor R80 and diode CR14 provide hysteresis that causes Q23 and Q36 to switch at an altitude above the nominal 875 feet during climbout.

When the aircraft descends through a nominal 275 feet, the dc analog altitude voltage decrease causes Q35 to conduct and Q21 turns on. Transistor Q21


+22 VDC
R77
R72
+22 VDC
Q20
Q35
Q21
R76
VR1
+22 VDC
R94
BANDWIDTH
CONT. NO 1
J2
R118
BANDWIDTH CONT
NO 1; LOW PASS
FILTER CKT.
Q27
C25
R138
-15 VDC
-15 VDC
-15 VDC
+22 VDC
R73
-15 VDC
R70
R74
R75
+22 VDC
R82
+22 VDC
DC ANALOG
ALT SIG;
ALT PROCESSOR
A1
R81
Q23
Q36
Q22
R78
CR9
+22 VDC
BANDWIDTH
CONT. NO 2
J3
R98
R119
BANDWIDTH CONT
NO 2; LOW PASS
FILTER CKT.
+22 VDC
R97
VR2
Q29
C26
+22 VDC
R84
R83
-15 VDC
R80
CR5
R79
R96
R139
-15 VDC
-15 VDC
-15 VDC
R85
Q28
+22 VDC
R89
+22 VDC
R91
Q24
Q37
Q25
R92
R93
Q26
+22 VDC
R88
R86
-15 VDC
R90
R87

TP3-7220-014

P/O Preamplifier/Filter A2, Bandwidth Control Circuit, Simplified Schematic Diagram
Figure 4-14

applies +22 V dc through R76 and VR1 to Q27. Transistor Q27 conducts and applies -15 V dc through R118 to J2 and to the low-pass filter circuit as the bandwidth control no 1 voltage. At a nominal 275 feet and below, the bandwidth control no 1 voltage is negative and the bandwidth control no 2 voltage is negative. Resistor R75 provides hysteresis that causes Q20 and Q35 to switch at an altitude above 275 feet during climbout.

The bandwidth control circuit output during the approach is as follows:

NOMINAL ALTITUDE (ft)	BANDWIDTH CONT NO 1 POLARITY	BANDWIDTH CONT NO 2 POLARITY
1,250 and above	+	+
875 to 1,250	-	+
275 to 875	+	-
0 to 275	-	-

4.4.1.6.4 Low-Pass Filter (Refer to figure 4-15)

The low-pass filter circuit consists of three identical, series, high-frequency, rolloff filter circuits, a high-frequency noise filter, and a limiter. The three rolloff filter circuits are controlled by the bandwidth control no 1 and no 2 dc voltages from the bandwidth control circuit. Because all three filter circuits operate the same way, only the first circuit is discused.

The sine-wave if signal from the preamplifier is applied through R22 to Q7. When the aircraft is above a nominal 1,250 feet, both bandwidth control no 1 and no 2 voltages are positive. The control no 1 voltage is applied through R25 to CR1 and the control no 2 voltage is applied through R26 to CR2. Since both voltages are positive, CR1 and CR2 are reverse biased and Q5 and Q6 are not reverse biased, causing Q5 and Q6 to turn on. With Q5 and Q6 turned on, resistors R22, R23, and R24 are connected in parallel. The parallel-connected resistors and capacitor C11 form the high-frequency rolloff filter network with a rolloff point of a nominal 124.7 kHz.

When the aircraft descends to a nominal 1,250 feet, the bandwidth control no 1 voltage switches to a nominal -4 V dc. The nominal -4 V dc is applied through R25 and CR1 to Q5. Transistor Q5 turns off, and resistors R22 and R24 are connected in parallel. The parallel-connected resistors and capacitor C11 form the high-frequency rolloff filter network with a rolloff point of a nominal 93.5 kHz.

When the aircraft descends to a nominal 875 feet, the bandwidth control no 1 voltage switches to a positive voltage and bandwidth control no 2 voltage switches to a nominal -4 V dc. The positive voltage is applied through R25 to CR1. Diode CR1 is reverse biased, causing Q5 to turn on. The nominal -4 V dc is applied through R21 and CR2 to Q6, causing Q6 to turn off. The switching of Q5 and Q6 causes R22 to be connected in parallel with R23. The parallel resistors and capacitor C11 form a high-frequency rolloff filter network with a rolloff point of a nominal 62.3 kHz.

When the aircraft descends to a nominal 275 feet, the bandwidth control no 1 voltage switches to a nominal -4 V dc and the bandwidth control no 2 voltage remains at a nominal -4 V dc. Transistors Q5 and Q6 are both reverse biased, and the high-frequency rolloff filter network consists of R22 and capacitor C11. The filter network sets the rolloff point at a nominal 31.1 kHz.

The filtered if signal is applied from the first high-frequency rolloff filter through amplifier Q7 to the second high-frequency rolloff filter. The second filter operates the same as described for the first filter and the if signal is applied through amplifier Q10 to the third high-frequency rolloff filter. The third filter operates the same as described for the first filter and the if signal is applied through amplifier Q13 and R44 to the high-frequency noise filter.

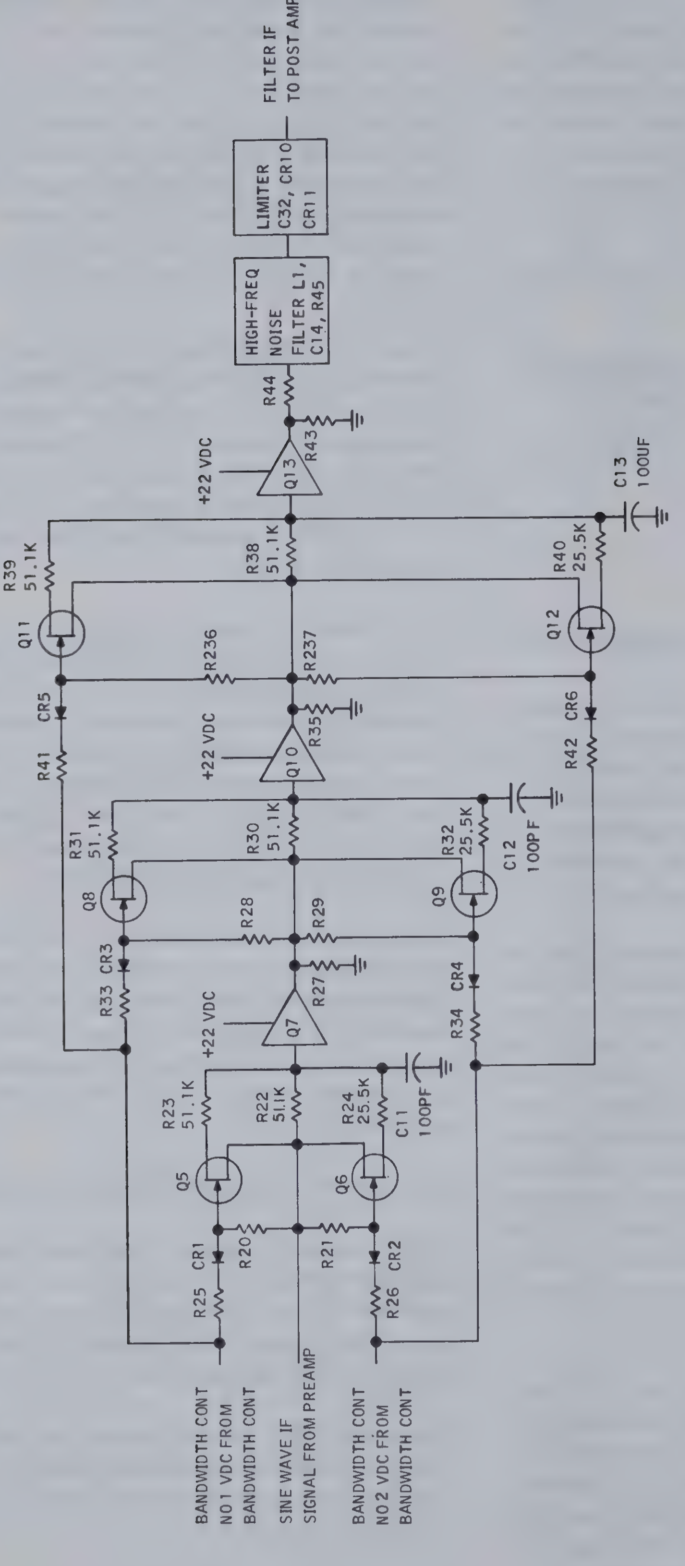
High-frequency noise filter L1, C14, R45 provides additional rolloff above 100 kHz and helps to remove high-frequency noise and applies the if signal to limiter C32, CR10, CR11. The limiter removes large amplitude signal changes that could cause signal distortion and clips the sine wave to approximately 1.0 volt peak to peak.

4.4.1.6.5 Postamplifier (Refer to figure 4-16)

The filtered if signal from the low-pass filter is applied to Q14. Transistor Q14 operates as an emitter-follower and provides isolation from the low-pass filter circuit. The if signal is applied from Q14 through coupling capacitor C37 to Q15.

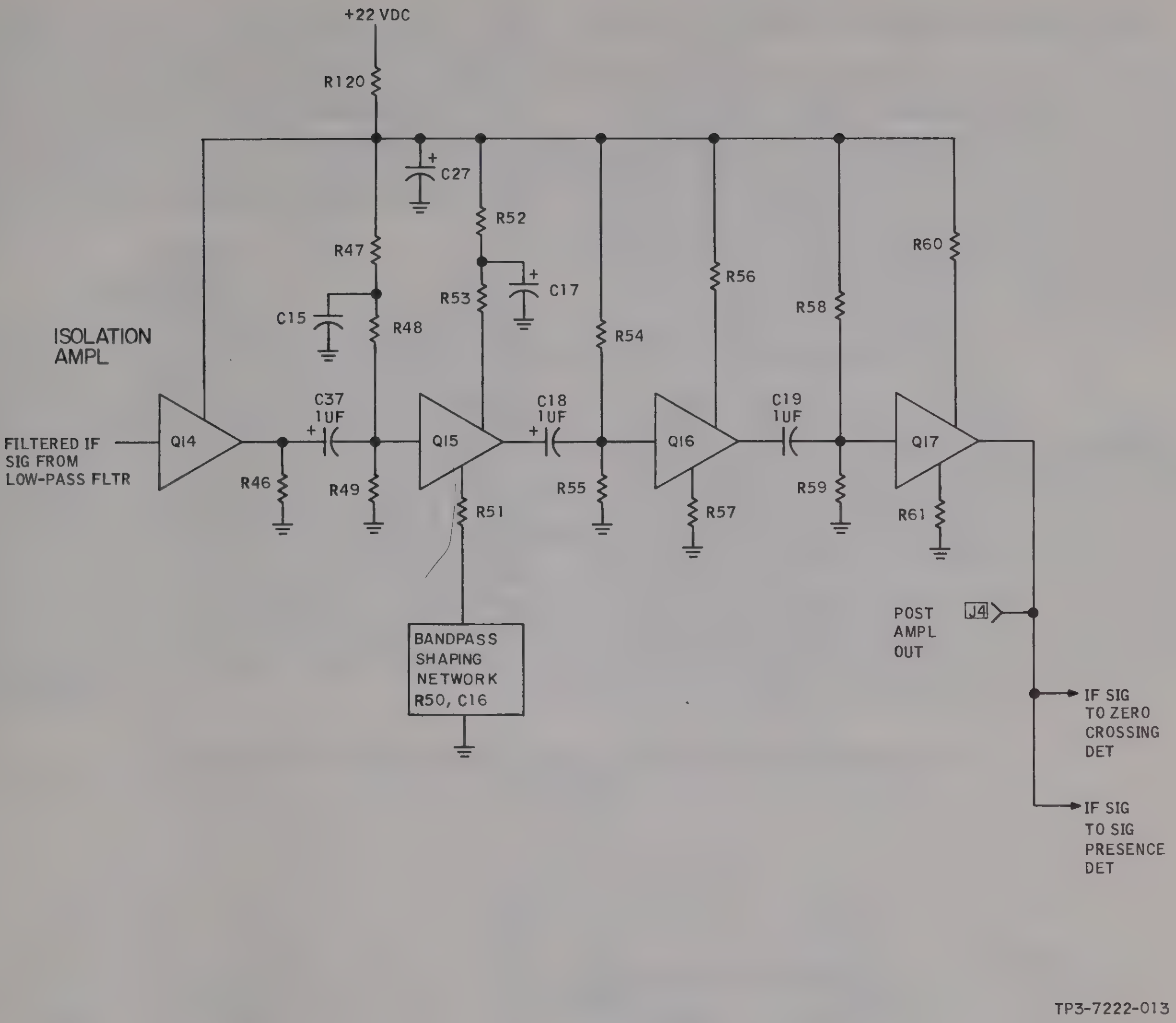
Transistor Q15 amplifies and applies the if signal through coupling capacitors C18 to Q16. Resistor R50 and C16 in the emitter circuit of Q15 form a bandpass shaping network.

Transistor Q16 amplifies and applies the if signal through coupling capacitor C19 to Q17. Transistor


BANDWIDTH CONT
NO 1 VDC FROM
BANDWIDTH CONT
SINE WAVE IF
SIGNAL FROM PREAMP
BANDWIDTH CONT
NO 2 VDC FROM
BANDWIDTH CONT
R25
CR1
R20
R21
R26
CR2
Q5
Q6
R23
51.1K
R22
51.1K
R24
25.5K
C11
100PF
+22 VDC
Q7
R27
R33
CR3
R34
CR4
Q8
Q9
R28
R29
R31
51.1K
R30
51.1K
R32
25.5K
C12
100PF
+22 VDC
Q10
R35
R41
CR5
R42
CR6
R236
R237
Q11
Q12
R39
51.1K
R38
51.1K
R40
25.5K
C13
100UF
+22 VDC
Q13
R43
R44
HIGH-FREQ
NOISE
FILTER L1,
C14, R45
LIMITER
C32, CR10
CR11
FILTER IF
TO POST AMPL

TP3-7221-014

P/O Preamplifier/Filter A2, Low-Pass Filter Circuit, Functional Diagram
Figure 4-15


+22 VDC
R120
C27
R52
R47
R60
R56
C17
R53
R58
C15
R48
R54
ISOLATION AMPL
C37 1UF
C18 1UF
C19 1UF
FILTERED IF SIG FROM LOW-PASS FLTR
Q14
Q15
Q16
Q17
R46
R49
R55
R59
R51
R57
R61
POST AMPL OUT
J4
BANDPASS SHAPING NETWORK R50, C16
IF SIG TO ZERO CROSSING DET
IF SIG TO SIG PRESENCE DET
TP3-7222-013

P/O Preamplifier/Filter A2, Postamplifier Circuit, Functional Diagram
Figure 4-16

Q17 amplifies and applies the if signal to J4, Q40, and the zero-crossing detector circuit, and to the signal presence detector circuit. Capacitors C15, C17, and C27 remove the ripple from the supply voltage and provide power lead isolation.

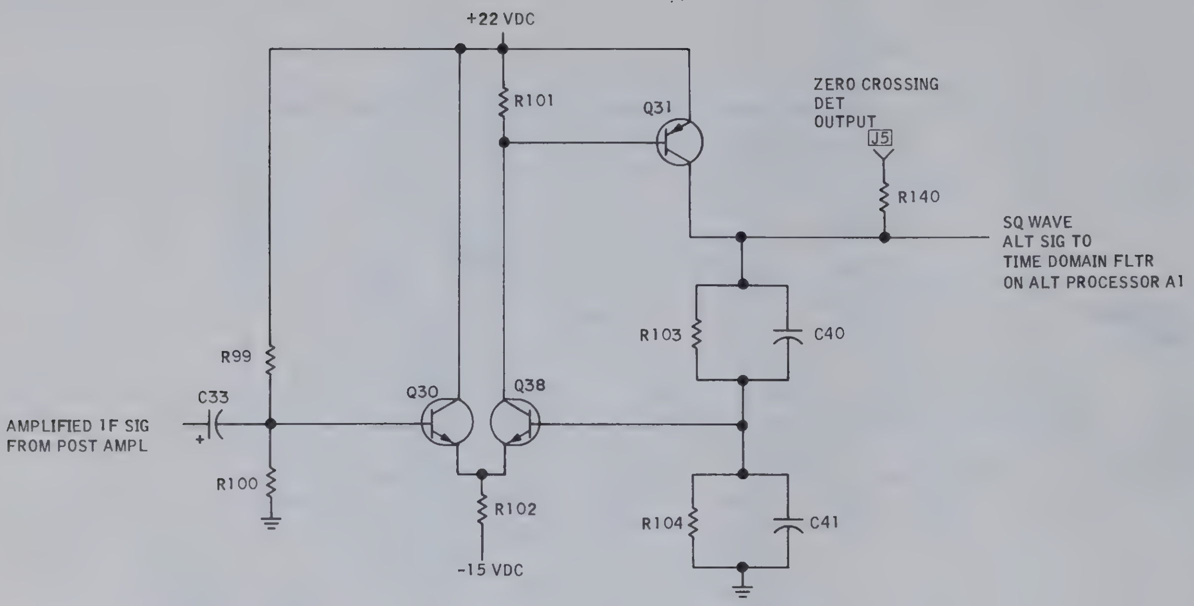
4.4.1.6.6 Zero-Crossing Detector (Refer to figure 4-17)

The if signal from the postamplifier is applied through coupling capacitor C33 to Q30. Transistor Q30 and Q38 operate as a high-gain comparator, and the base voltage of Q38 determines the switching point on the incoming signal waveforms. The output from Q30/Q38 is applied through amplifier Q31 to the time domain filter circuit on altitude processor A1 and through R140 to J5.

4.4.1.6.7 Signal Presence Detector (Refer to figure 4-18)

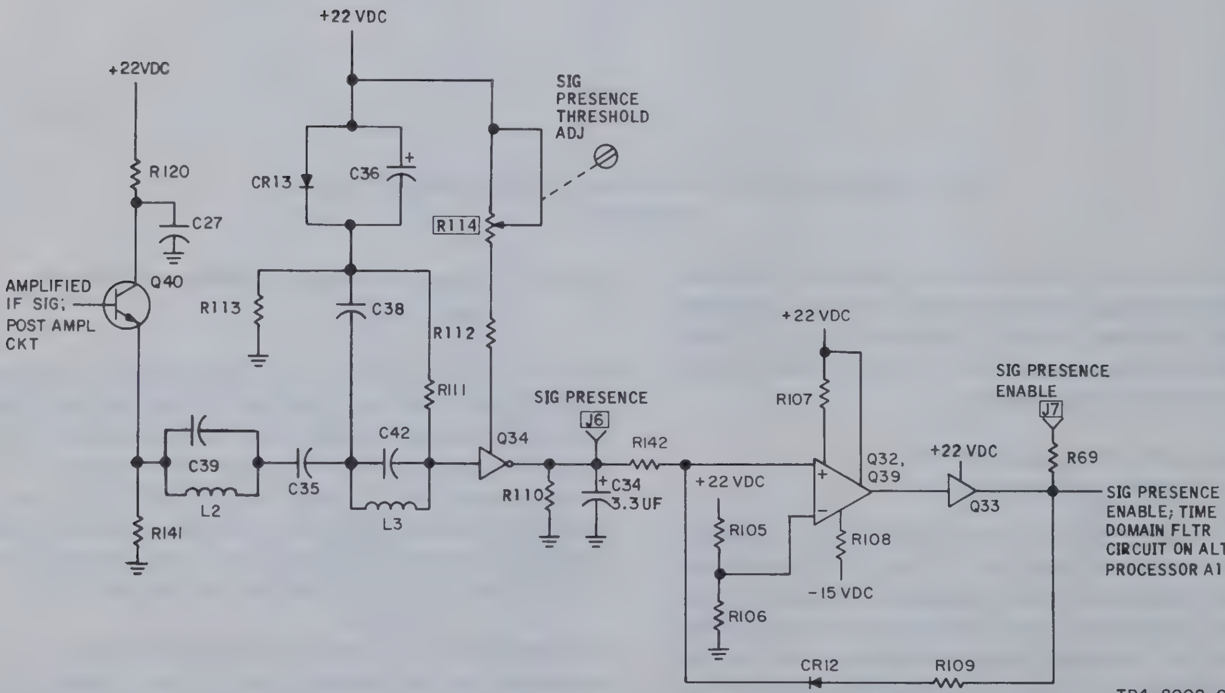
The if signal from the postamplifier is applied through isolation amplifier Q40 to the low-pass filter circuit. The low-pass filter circuit consists of C39, L2, C38, C42, and L3. The low-pass filter causes rapid response decay of the signal above 100 kHz to ensure removal of signal presence enable signal at altitudes above a nominal 2,000 feet. From the low-pass filter circuit, the if signal is applied to transistor Q34.

Transistor Q34 is biased to operate as a class B detector/amplifier with a sharp cutoff point. Diode CR13 clamps the +22-V dc supply voltage applied through R111 to the base of Q34 at a nominal 0.6 volt below


+22 VDC
R101
Q31
ZERO CROSSING
DET
OUTPUT
J5
R140
SQ WAVE
ALT SIG TO
TIME DOMAIN FLTR
ON ALT PROCESSOR A1
R103
C40
R99
C33
Q30
Q38
AMPLIFIED IF SIG
FROM POST AMPL
+
R100
R102
-15 VDC
R104
C41

TP3-7223-013

P/O Preamplifier/Filter A2, Zero Crossing Detector Circuit, Simplified Schematic Diagram
Figure 4-17


+22 VDC
+22VDC
SIG
PRESENCE
THRESHOLD
ADJ
R120
CR13
C36
+
C27
R114
AMPLIFIED
IF SIG;
POST AMPL
CKT
Q40
R113
C38
R112
+22 VDC
R111
SIG PRESENCE
J6
SIG PRESENCE
ENABLE
J7
R107
C42
Q34
R142
C39
C35
L2
L3
R110
+
C34
3.3UF
+22 VDC
+
−
Q32,
Q39
+22 VDC
Q33
R69
SIG PRESENCE
ENABLE; TIME
DOMAIN FLTR
CIRCUIT ON ALT
PROCESSOR A1
R141
R105
R108
-15 VDC
R106
CR12
R109

TP4-8008-013

P/O Preamplifier/Filter A2, Signal Presence Detector Circuit, Functional Diagram
Figure 4-18

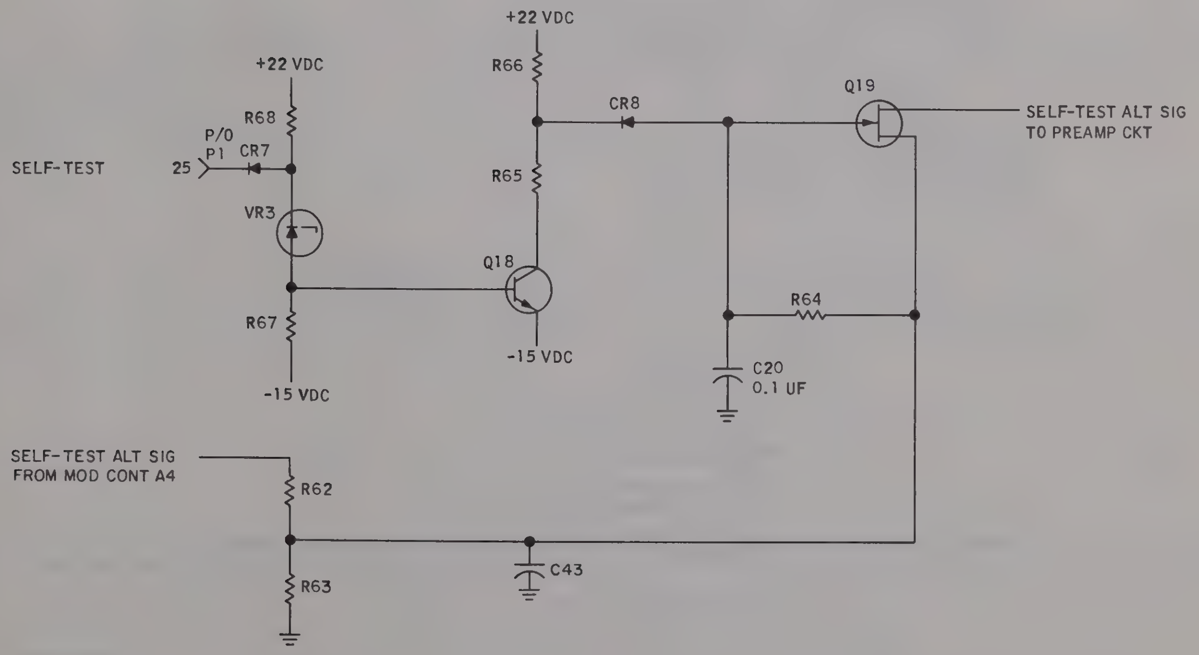
the +22-V dc supply voltage applied through R112 and R114 to the emitter of Q34. The clamped bias voltage ensures fast switching of Q34 regardless of the R114 adjustment. Capacitor C36 bypasses diode CR13. Variable resistor R114 adjusts the threshold of the signal presence circuit to ensure altimeter performance with a 250-foot ground return signal with a 102-dB loss.

With each negative half-cycle of the if signal, Q34 turns on and applies a positive pulse to C34. Capacitor C34 charges to a level that attempts to forward bias Q32 through R142. Transistors Q32/Q39 operate as a voltage comparator and a nominal +5.5-V dc reference voltage is applied to Q39. When the voltage applied to Q32 exceeds the reference voltage, Q32 turns on and forward biases Q33. Transistor Q33 applies +22 V dc to the time domain filter circuit on altitude processor A1, through R69 to J7, and through R109 and CR12 to Q32. The positive feedback provides hysteresis to ensure positive switching of Q32 and Q39.

4.4.1.6.8 Self-Test Gate (Refer to figure 4-19)

The self-test altitude signal from modulator control A4 is applied through voltage divider R62, R63 to Q19. Capacitor C43 and resistor A4R64 form an integrator that provides proper shaping of the self-test signal. The +22-V dc supply voltage is applied through voltage divider R68, VR3, R67 to Q18. Transistor Q18 is forward biased and applies -15 V dc through R65 and CR8 to Q19. Transistor Q19 is reverse biased and no self-test altitude signal is applied to the preamplifier circuit.

When the self-test mode is selected, a ground is applied through rear connector P1-25 and CR7 to voltage divider R68, VR3, R67. Voltage divider R68, VR3, R67 applies a negative voltage to Q18 and Q18 turns off causing the reverse bias to be removed from Q19. Transistor Q19 turns on and applies the signal to the preamplifier circuit. Capacitor C20 prevents accidental switching of Q19 due to noise. Voltage regulator VR3 prevents switching of the self-test gate circuit due to noise on the self-test input from P1-25.



TP4-8007-013

P/O Preamplifier/Filter A2, Self-Test Gate Circuit, Simplified Diagram
Figure 4-19

4.4.1.7 Altitude Processor A1 (Refer to figure 4-20)

4.4.1.7.1 General

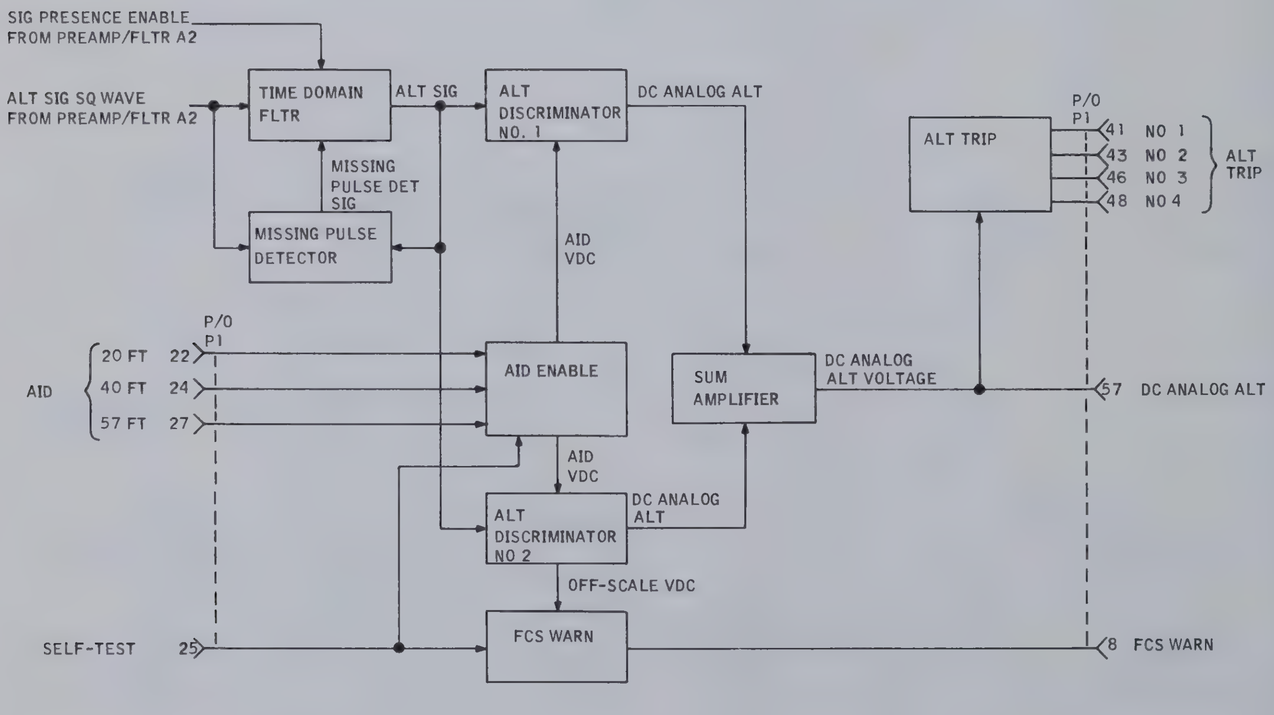
Altitude processor A1 consists of a time domain filter circuit, a missing pulse detector circuit, an altitude discriminator no 1 circuit, an altitude discriminator no 2 circuit, a sum amplifier circuit, an AID enable circuit, and an FCS warn circuit.

4.4.1.7.2 Time Domain Filter (Refer to figure 4-21)

The altitude signal from the zero-crossing detector on preamplifier/filter A2 is applied to the junction of R1 and C1. Capacitor C1, resistor R2, and the base-emitter junction of Q1 form a differentiator that converts the signal to positive-going trigger pulses at the base of Q1. Diode CR1 clips the negative pulse of each cycle and prevents a negative-going trigger pulse.

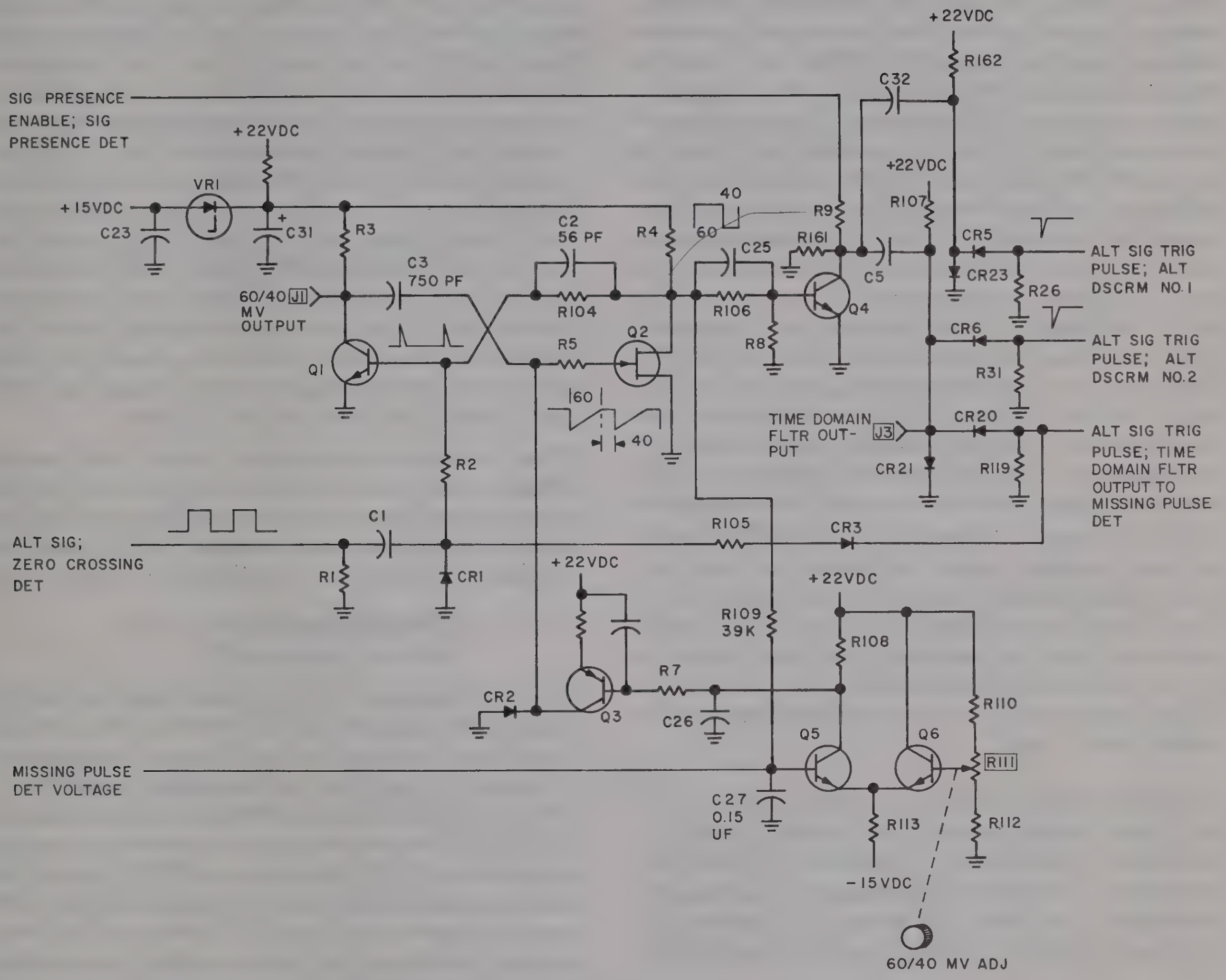
Transistors Q1 and Q2 operate as a monostable multivibrator that is adjusted to produce a 60/40 duty cycle rectangular wave output. Capacitor C2 speeds up the switching of Q1. The 60/40 duty cycle is applied through voltage divider R106, R8 to Q4 and to integrator R109, C27. Capacitor C25 speeds up the switching of Q4.

Integrator R109, C27 operates as a filter that converts the 60/40 rectangular wave to a dc level. The dc voltage is the average dc voltage of the 60/40 duty cycle and is applied to Q5. Therefore, the width of the 60-percent positive portion of the duty cycle determines the dc level applied to Q5. Transistors Q5 and Q6 operate as a voltage comparator. Voltage divider R110, R111, R112 applies a dc reference voltage to Q6. Variable resistor R111 adjusts the threshold of Q6. The Q5 output depends upon the dc level of the input with respect to the threshold of Q6. Transistor Q5 applies a dc voltage through R7 to Q3. The collector current of Q3 increases as the Q5 collector voltage


SIG PRESENCE ENABLE
FROM PREAMP/FLTR A2
ALT SIG SQ WAVE
FROM PREAMP/FLTR A2
TIME DOMAIN
FLTR
ALT SIG
ALT
DISCRIMINATOR
NO. 1
DC ANALOG ALT
MISSING
PULSE DET
SIG
MISSING PULSE
DETECTOR
AID
VDC
P/O
P1
ALT TRIP
41 NO 1
43 NO 2
46 NO 3
48 NO 4
ALT
TRIP
AID
20 FT 22
40 FT 24
57 FT 27
AID ENABLE
SUM
AMPLIFIER
DC ANALOG
ALT VOLTAGE
57 DC ANALOG ALT
AID
VDC
DC ANALOG
ALT
ALT
DISCRIMINATOR
NO 2
OFF-SCALE VDC
FCS WARN
SELF-TEST 25
8 FCS WARN

TP3-7201-013

Altitude Processor A1, Block Diagram
Figure 4-20


+22VDC
R162
C32
SIG PRESENCE ENABLE; SIG PRESENCE DET
+22VDC
+22VDC
R107
40
R9
+15VDC
VR1
C23
C31
R3
C2 56 PF
R4
60
C25
R161
CR5
ALT SIG TRIG PULSE; ALT DSCRM NO.1
C3 750 PF
C5
CR23
R26
60/40 J1 MV OUTPUT
R104
R106
Q4
R5
Q2
R8
CR6
ALT SIG TRIG PULSE; ALT DSCRM NO.2
Q1
R31
60
40
TIME DOMAIN FLTR OUTPUT J3
CR20
ALT SIG TRIG PULSE; TIME DOMAIN FLTR OUTPUT TO MISSING PULSE DET
R2
CR21
R119
ALT SIG; ZERO CROSSING DET
C1
R105
CR3
R1
CR1
+22VDC
+22VDC
R109 39K
R108
R7
CR2
Q3
C26
Q5
Q6
R110
MISSING PULSE DET VOLTAGE
R111
C27 0.15 UF
R113
R112
-15VDC
60/40 MV ADJ

TP3-7228-013

P/O Altitude Processor A1, Time Domain Filter Circuit, Simplified Schematic Diagram
Figure 4-21

decreases, causing the discharge current of C3 to increase. The discharge of C3 applies a ramp voltage through R5 to Q2. Transistor Q2 turns on when the ramp voltage approaches zero. The discharge time of C3 determines the width of the 60-percent positive portion of the waveform. Resistor R111 is adjusted to set the threshold of Q6 to lengthen or shorten the 60-percent positive portion of the waveform. The signal presence enable signal from the signal presence detector circuit on preamplifier/filter A2 is applied through R9 to Q4. When the ground return signal is strong enough to provide correct altitude information, a positive dc voltage is applied to the collector of Q4. The 60/40 waveform from the monostable multivibrator is applied through R106 to the base of Q4. Transistor Q4 turns on during each positive portion of the waveform and applies a 60/40 waveform to C5 and C32. Capacitor C5, resistor R107, and diode CR21 form a differentiator that converts the rectangular wave to a negative trigger pulse. Diodes CR6 and CR20 block the positive-going trigger and gate the negative-going trigger pulses to altitude discriminator no 2 and the missing pulse detector circuit. Capacitor C32, resistor R162, and diode CR23 form a differentiator that converts the rectangular wave to a negative trigger pulse. Diode CR5 blocks the positive-going trigger and gates the negative-going trigger pulses to altitude discriminator no 1. Diode CR3 blocks the negative-going altitude signal pulses and gates the positive-going trigger pulses to Q27 in the missing-pulse detector circuit each time a trigger pulse is applied to Q1 in the 60/40 monostable multivibrator circuit.

When the missing pulse detector circuit senses a major altitude change that requires tracking, a positive dc voltage is applied to Q5. Transistor Q5 saturates, causing Q3 to saturate, and capacitor C3 is instantly discharged. The instant discharge of C3 allows the 60/40 multivibrator to track the new altitude signal.

4.4.1.7.3 Missing Pulse Detector (Refer to figure 4-22)

Transistors Q27 and Q28 operate as a bistable multivibrator. In normal altimeter operation, Q27 is biased off and Q28 is biased on. During normal operation, the positive trigger pulse derived from the altitude signal (ALT SIG TRIG) and the negative trigger pulse derived from the time domain filter circuit (TIME DOMAIN FLTR OUTPUT) are developed across R119 almost simultaneously. The resultant trigger is applied to the base of Q27, but is insufficient to bias Q27 on.

When a major increase in altitude suddenly occurs, the time domain filter cannot immediately respond to all the triggers because of the 60/40 feedback. The time domain filter then divides the trigger frequency by 2, so that a negative trigger from the time domain filter occurs only for every second positive trigger from the altitude signal. Thus every second positive trigger from the altitude signal turns on Q27 until the next positive trigger occurs. The multivibrator pulse that results may be observed at J2 and is applied through R118 to C30, and develops a voltage that is applied to the base of Q29. Transistors Q29 and Q30 operate as a voltage comparator with a dc reference voltage applied to Q30. When the voltage applied to Q29 base exceeds the reference voltage, Q29 turns on and forward biases Q43. Transistor Q43 turns on and applies +22 V dc through VR3 to the time-domain filter circuit. The Q29 base voltage does not exceed the reference voltage until approximately one-half second after the sudden altitude increase. Then Q29 will switch and, through Q43, will cause the 60/40 multivibrator to track the new altitude.

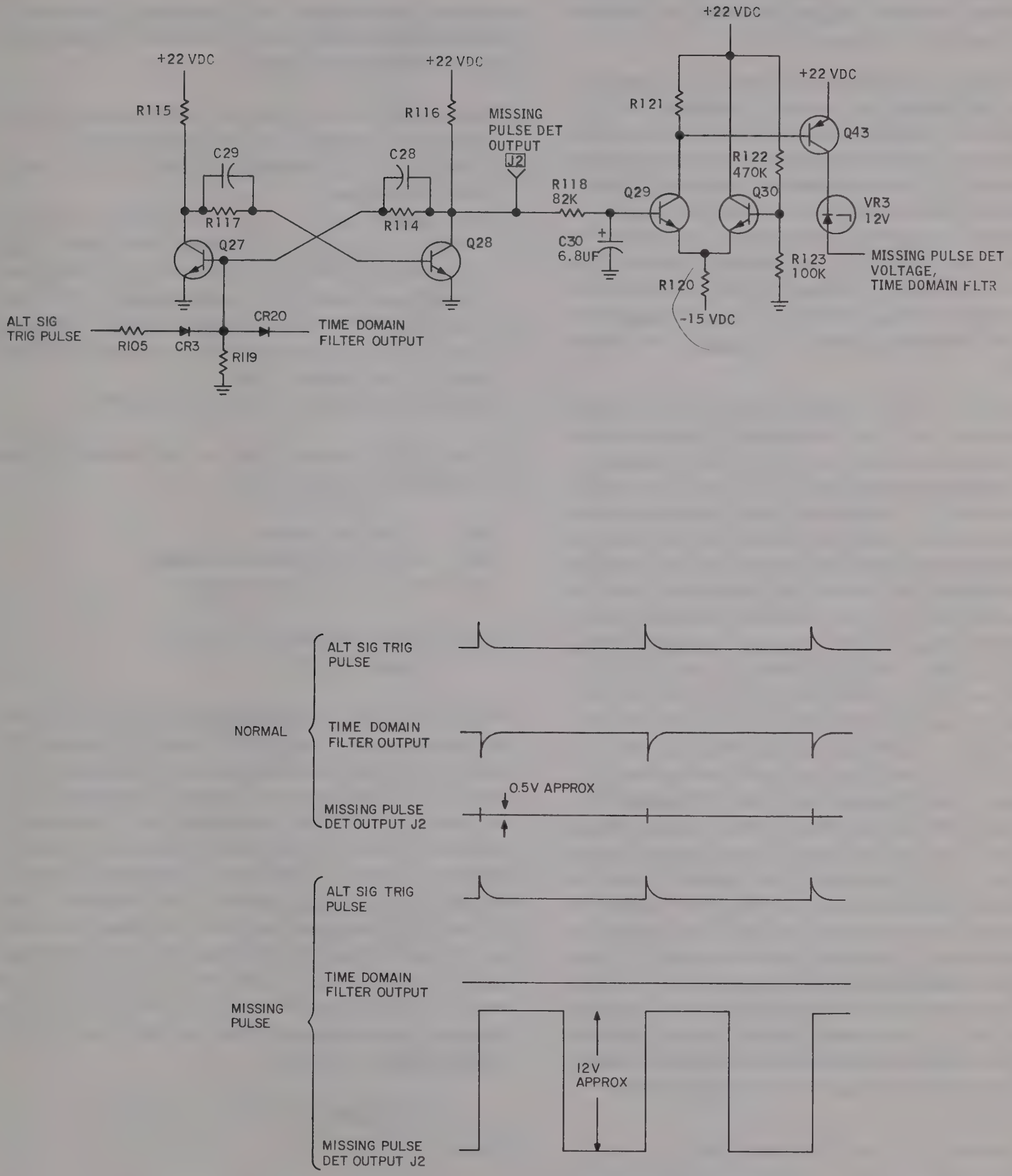
When a double-bounce signal occurs, the positive trigger pulse that occurs between the two normal trigger pulses does not occur steadily for one-half second. Under these circumstances, C30 is unable to develop a dc level that is sufficient to turn on Q29.

4.4.1.7.4 Altitude Discriminator No 1 (Refer to figure 4-23)

The negative altitude trigger pulse from the time domain filter is applied to Q7. Transistors Q7 and Q8 operate as a monostable multivibrator that produces a nominal 14-μs-wide, positive-going pulse that is applied to test jack J4 and through coupling capacitor C8 to Q11. The pulse width is determined by the discharge time of C6. Adjustment of R21 changes the discharge time of C6, which changes the slope of the ramp voltage applied to Q7. The slope of the ramp voltage establishes the pulse width of the multivibrator output. Temperature compensation is provided by RT1 in voltage divider R24, R25, R27, RT1.

The -15 V dc is applied through R30 to the gate of Q11 causing the multivibrator pulse to be biased into the negative region. Transistor Q11 operates as an isolation amplifier and inverter. The positive-going 14-μs-wide pulse turns on Q11 and causes the output of Q11 to go negative. The output of Q11 is applied to the inverting input of U1.

An aircraft installation delay (AID) voltage that adjusts the signal for delays incorporated during the installation of the system is applied through R43 and


+22 VDC
R115
C29
R117
Q27
+22 VDC
R116
C28
R114
Q28
MISSING PULSE DET OUTPUT
J2
R118 82K
C30 6.8UF
+22 VDC
R121
R122 470K
Q29
Q30
R120
-15 VDC
R123 100K
+22 VDC
Q43
VR3 12V
MISSING PULSE DET VOLTAGE, TIME DOMAIN FLTR
ALT SIG TRIG PULSE
R105
CR3
R119
CR20
TIME DOMAIN FILTER OUTPUT
NORMAL
ALT SIG TRIG PULSE
TIME DOMAIN FILTER OUTPUT
MISSING PULSE DET OUTPUT J2
0.5V APPROX
MISSING PULSE
ALT SIG TRIG PULSE
TIME DOMAIN FILTER OUTPUT
MISSING PULSE DET OUTPUT J2
12V APPROX
TP3-7226-014

P/O Altitude Processor A1, Missing Pulse Detector Circuit, Simplified Schematic Diagram
Figure 4-22

R42 to the inverting input of U1. The voltage changes the reference level of the pulse from Q11. During the self-test mode, the AID voltage is removed to prevent an erroneous altitude indication since the self-test signal is developed internally.

Diodes CR8 and CR9 limit the inputs to a nominal 0.6-V dc difference to prevent overdrive of U1. Voltage divider R49, R47, R45, R44 produces an offset voltage that is applied through R46 to the noninverting input of U1. Variable resistor R45 is adjusted to provide an offset voltage that will provide a correct 0-foot-altitude indication. Operational amplifier U1 operates as an integrator and converts the altitude pulses to a dc analog voltage that is applied to the sum amplifier, through R52 to Q13 and through R69 to Q15. The dc analog altitude voltage is 17 millivolts per foot.

Capacitor C18 removes noise from the dc altitude voltage applied to Q15A. Transistor Q15 operates as a voltage comparator and a dc reference voltage is applied from voltage divider R71, R72, R73 to Q15B. Potentiometer R71 is adjusted to set the dc reference voltage to +8.84 V dc or an altitude of 500 feet. At altitudes above 500 feet, the altitude voltage applied to Q15A exceeds the +8.84-V dc reference applied to Q15B, and Q15A turns on. Transistor Q15A applies a negative dc voltage to Q17, and Q17 turns on. Transistor Q17 applies +22 V dc through voltage divider R53, R54 to Q13. Transistor Q13 turns on and connects R52 in parallel with R51 in the feedback loop. The connection of R51 in parallel with R52 reduces the gain of U1 to less than unity and constrains U1 to produce a +8.84-V dc output at all altitudes above 500 feet. At altitudes below 500 feet, the altitude voltage applied to Q15A is less than the reference voltage applied to Q15B. Transistor Q15A turns off and the base current applied to Q17 is removed. Transistor Q17 turns off and removes the +22 V dc applied to Q13. Transistor Q13 turns off and removes R52 from the feedback loop to the inverting gate of U1. The output of U1 decreases as the altitude or pulse input to the gate of U1 decreases. The dc analog altitude voltage for altitudes from 0 to 500 feet at the output of U1 is calculated using the following formula:

U1 analog V dc = (H + 20) x 0.017

Where: U1 analog V dc = dc analog altitude voltage at output of U1

H = height in feet
20 = height to 0-foot altitude
0.017 = V dc per foot analog

4.4.1.7.5 *Altitude Discriminator No 2 (Refer to figure 4-23)*

Altitude discriminator no 2 operates the same as altitude discriminator no 1 (described in paragraph 4.4.1.7.4) except as follows:

1. Monostable multivibrator Q9, Q10 produces a 2-μs-wide pulse instead of a 14-μs-wide pulse.
2. Integrator U2 produces a 3-mV/ft dc analog altitude voltage.
3. The limiter circuit is not adjustable and the reference voltage in the limiter circuit is set at approximately 3,000 feet. Therefore, the integrator U2 output is clamped at approximately +9.0 V dc.
4. The limiter circuit provides an off-scale voltage to the FCS warn circuit when the altitude voltage reaches the limiting value.
5. U2 analog voltage = (H + 20) x 0.003

   Where: U2 analog V dc = dc analog altitude voltage at output of U2

   H = height in feet
   20 = height to 0-foot altitude
   0.003 = V dc per foot analog

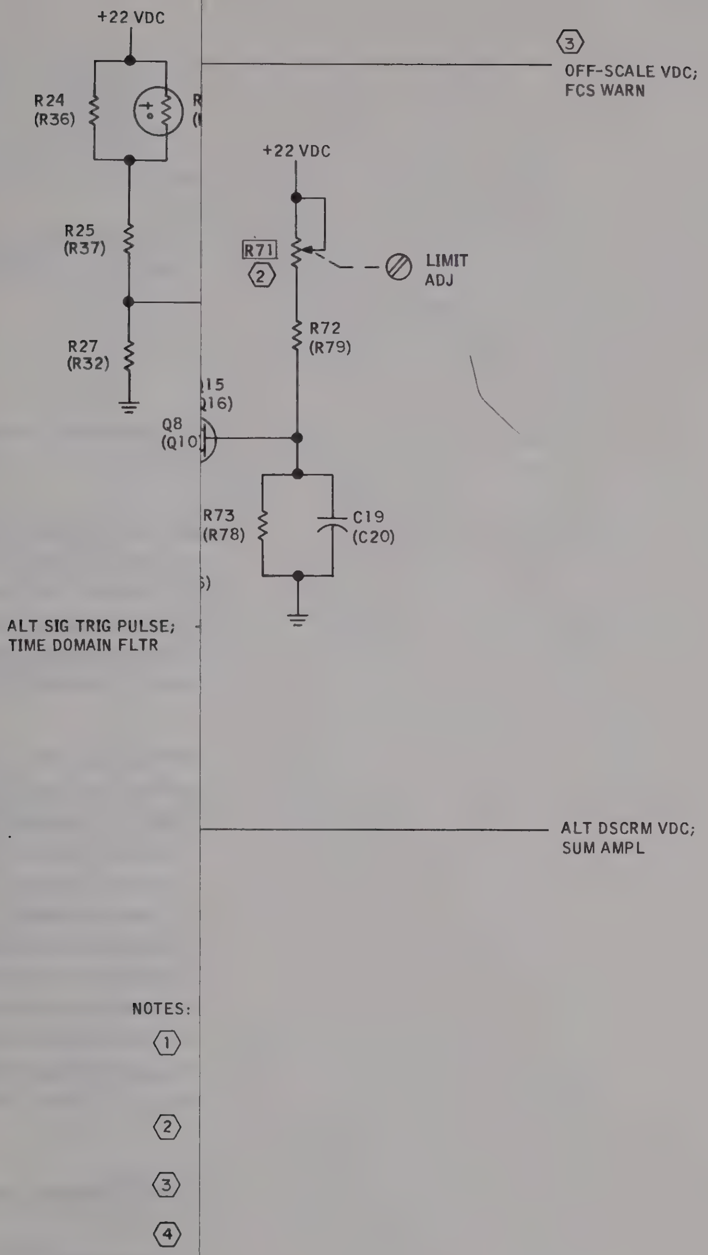
4.4.1.7.6 *Sum Amplifier (Refer to figure 4-24)*

The 17-mV/ft dc analog altitude signal from altitude discriminator no 1 is applied through R56 to a mixing point. The 3-mV/ft dc analog altitude signal from altitude discriminator no 2 is applied through R57 to the mixing point. The two signals are combined to produce a 20-mV/ft dc analog altitude voltage for altitudes of from 0 to 500 feet. At altitudes above 500 feet, the two analog signals mix to produce a 10.4-V dc plus 3-mV/ft dc analog altitude voltage. For example, if the altitude is 550 feet, the analog voltage would be +10.4 V dc for 500 feet + 3 millivolts x 50 feet = +10.4 V dc = 0.15 V dc or +10.55 V dc. The following formulas are used to determine the dc analog altitude voltage:

0 to 500 feet, V = 0.02 x (H + 20)

Where:

V = dc analog altitude voltage
0.02 = dc voltage per foot of altitude
H = altitude in feet
20 = altitude in feet to obtain a 0-foot altitude indication (0.0 V dc = -20 feet).


+22 VDC
R24
(R36)
R25
(R37)
R27
(R32)
15
16)
Q8
(Q10
3
OFF-SCALE VDC;
FCS WARN
+22 VDC
R71
2
LIMIT
ADJ
R72
(R79)
R73
(R78)
C19
(C20)
ALT SIG TRIG PULSE;
TIME DOMAIN FLTR
ALT DSCRM VDC;
SUM AMPL
NOTES:
1
2
3
4

TP3-7202-014

minator Circuit, Simplified Schematic Diagram
Figure 4-23

R42 to the inverting input of U1. The voltage changes the reference level of the pulse from Q11. During the self-test mode, the AID voltage is removed to prevent an erroneous altitude indication since the self-test signal is developed internally.

Diodes CR8 and CR9 limit the inputs to a nominal 0.6-V dc difference to prevent overdrive of U1. Voltage divider R49, R47, R45, R44 produces an offset voltage that is applied through R46 to the noninverting input of U1. Variable resistor R45 is adjusted to provide an offset voltage that will provide a correct 0-foot-altitude indication. Operational amplifier U1 operates as an integrator and converts the altitude pulses to a dc analog voltage that is applied to the sum amplifier, through R52 to Q13 and through R69 to Q15. The dc analog altitude voltage is 17 millivolts per foot.

Capacitor C18 removes noise from the dc altitude voltage applied to Q15A. Transistor Q15 operates as a voltage comparator and a dc reference voltage is applied from voltage divider R71, R72, R73 to Q15B. Potentiometer R71 is adjusted to set the dc reference voltage to +8.84 V dc or an altitude of 500 feet. At altitudes above 500 feet, the altitude voltage applied to Q15A exceeds the +8.84-V dc reference applied to Q15B, and Q15A turns on. Transistor Q15A applies a negative dc voltage to Q17, and Q17 turns on. Transistor Q17 applies +22 V dc through voltage divider R53, R54 to Q13. Transistor Q13 turns on and connects R52 in parallel with R51 in the feedback loop. The connection of R51 in parallel with R52 reduces the gain of U1 to less than unity and constrains U1 to produce a +8.84-V dc output at all altitudes above 500 feet. At altitudes below 500 feet, the altitude voltage applied to Q15A is less than the reference voltage applied to Q15B. Transistor Q15A turns off and the base current applied to Q17 is removed. Transistor Q17 turns off and removes the +22 V dc applied to Q13. Transistor Q13 turns off and removes R52 from the feedback loop to the inverting gate of U1. The output of U1 decreases as the altitude or pulse input to the gate of U1 decreases. The dc analog altitude voltage for altitudes from 0 to 500 feet at the output of U1 is calculated using the following formula:

U1 analog V dc = (H + 20) x 0.017

Where: U1 analog V dc = dc analog altitude voltage at output of U1

H = height in feet
20 = height to 0-foot altitude
0.017 = V dc per foot analog

4.4.1.7.5 Altitude Discriminator No 2 (Refer to figure 4-23)

Altitude discriminator no 2 operates the same as altitude discriminator no 1 (described in paragraph 4.4.1.7.4) except as follows:

1. Monostable multivibrator Q9, Q10 produces a 2-μs-wide pulse instead of a 14-μs-wide pulse.
2. Integrator U2 produces a 3-mV/ft dc analog altitude voltage.
3. The limiter circuit is not adjustable and the reference voltage in the limiter circuit is set at approximately 3,000 feet. Therefore, the integrator U2 output is clamped at approximately +9.0 V dc.
4. The limiter circuit provides an off-scale voltage to the FCS warn circuit when the altitude voltage reaches the limiting value.
5. U2 analog voltage = (H + 20) x 0.003

   Where: U2 analog V dc = dc analog altitude voltage at output of U2

   H = height in feet
   20 = height to 0-foot altitude
   0.003 = V dc per foot analog

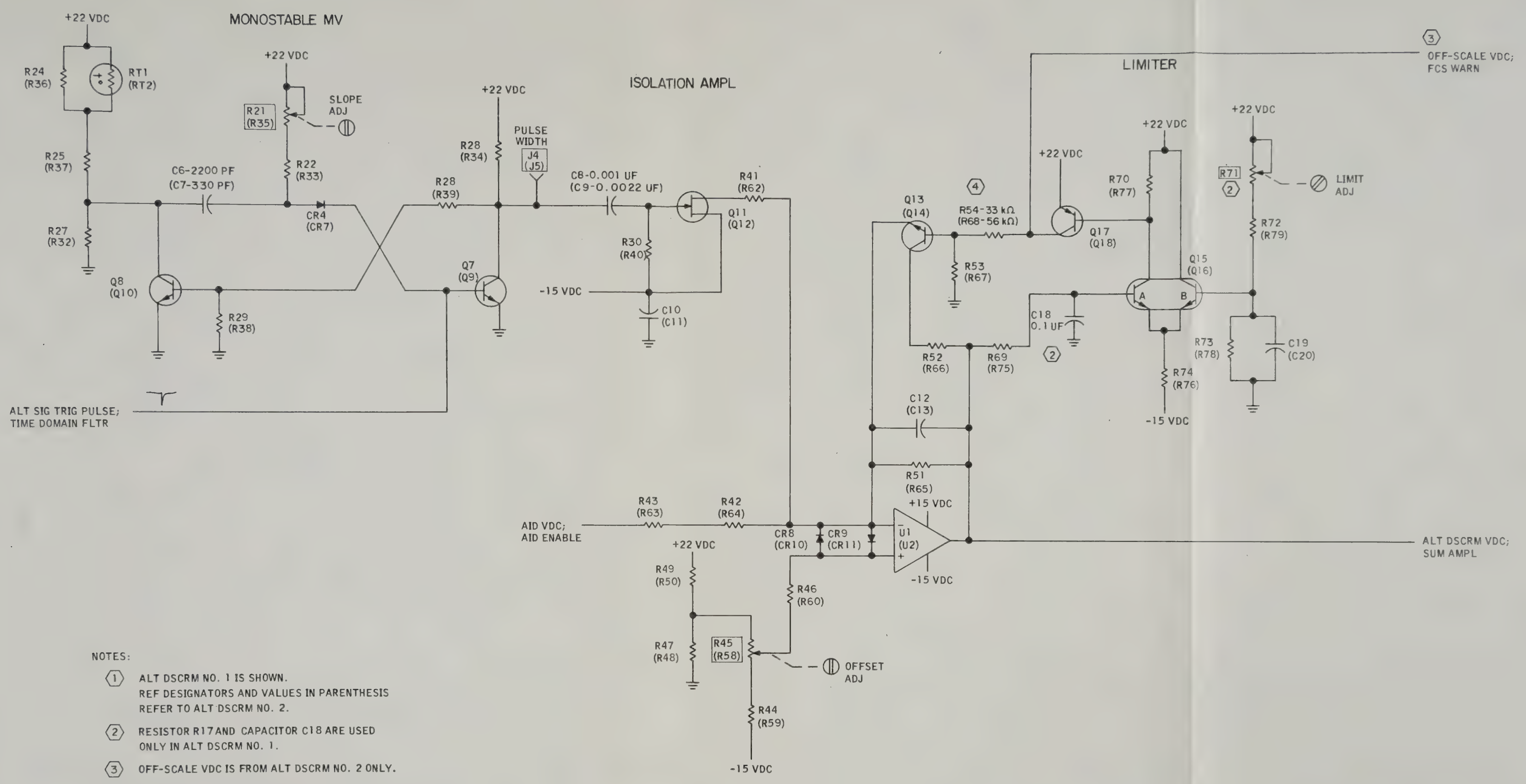
4.4.1.7.6 Sum Amplifier (Refer to figure 4-24)

The 17-mV/ft dc analog altitude signal from altitude discriminator no 1 is applied through R56 to a mixing point. The 3-mV/ft dc analog altitude signal from altitude discriminator no 2 is applied through R57 to the mixing point. The two signals are combined to produce a 20-mV/ft dc analog altitude voltage for altitudes of from 0 to 500 feet. At altitudes above 500 feet, the two analog signals mix to produce a 10.4-V dc plus 3-mV/ft dc analog altitude voltage. For example, if the altitude is 550 feet, the analog voltage would be +10.4 V dc for 500 feet + 3 millivolts x 50 feet = +10.4 V dc = 0.15 V dc or +10.55 V dc. The following formulas are used to determine the dc analog altitude voltage:

0 to 500 feet, V = 0.02 x (H + 20)

Where:

V = dc analog altitude voltage
0.02 = dc voltage per foot of altitude
H = altitude in feet
20 = altitude in feet to obtain a 0-foot altitude indication (0.0 V dc = -20 feet).


+22 VDC
MONOSTABLE MV
R24
(R36)
RT1
(RT2)
+22 VDC
R21
(R35)
SLOPE
ADJ
R25
(R37)
C6-2200 PF
(C7-330 PF)
R22
(R33)
CR4
(CR7)
R27
(R32)
Q8
(Q10)
R29
(R38)
+22 VDC
R28
(R34)
R28
(R39)
Q7
(Q9)
PULSE
WIDTH
J4
(J5)
ISOLATION AMPL
C8-0.001 UF
(C9-0.0022 UF)
R30
(R40)
-15 VDC
C10
(C11)
Q11
(Q12)
R41
(R62)
ALT SIG TRIG PULSE;
TIME DOMAIN FLTR
LIMITER
③
OFF-SCALE VDC;
FCS WARN
+22 VDC
+22 VDC
+22 VDC
④
Q13
(Q14)
R54-33 kΩ
(R68-56 kΩ)
R53
(R67)
Q17
(Q18)
R70
(R77)
R71
②
LIMIT
ADJ
R72
(R79)
Q15
(Q16)
A
B
C18
0.1 UF
②
R52
(R66)
R69
(R75)
R74
(R76)
-15 VDC
R73
(R78)
C19
(C20)
C12
(C13)
R51
(R65)
+15 VDC
R43
(R63)
R42
(R64)
AID VDC;
AID ENABLE
CR8
(CR10)
CR9
(CR11)
U1
(U2)
-15 VDC
ALT DSCRM VDC;
SUM AMPL
+22 VDC
R49
(R50)
R46
(R60)
R47
(R48)
R45
(R58)
OFFSET
ADJ
R44
(R59)
-15 VDC

NOTES:

① ALT DSCRM NO. 1 IS SHOWN.
REF DESIGNATORS AND VALUES IN PARENTHESIS
REFER TO ALT DSCRM NO. 2.

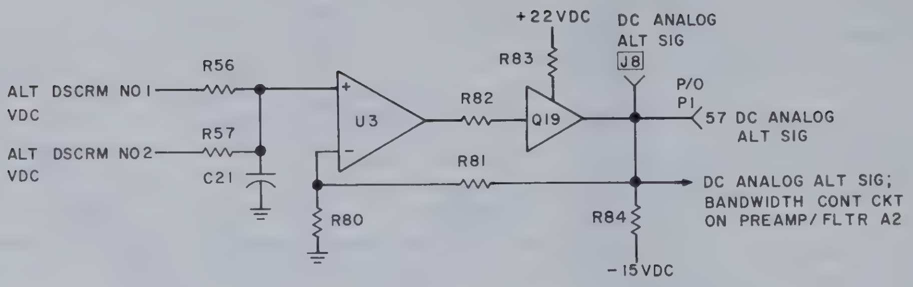
② RESISTOR R17 AND CAPACITOR C18 ARE USED
ONLY IN ALT DSCRM NO. 1.

③ OFF-SCALE VDC IS FROM ALT DSCRM NO. 2 ONLY.

④ R54 AND R68 ARE BOTH 33KΩ ON
AN 860F-2 RADIO ALTIMETER.

TP3-7202-014

P/O Altitude Processor A1, Discriminator Circuit, Simplified Schematic Diagram
Figure 4-23



A

TP3-7229-012

P/O Altitude Processor A1, Sum Amplifier Circuit, Functional Diagram
Figure 4-24

500 to 2,000 feet, V = 10.4 + (H - 500) x 0.003

Where:

V = dc analog altitude voltage
10.4 = dc analog altitude voltage for 500 feet
H = altitude in feet
500 = altitude for 10.4-V dc analog altitude above 500 feet
0.003 = dc analog voltage per foot for altitude above 500 feet.

The dc analog altitude voltage is applied through amplifier U3, resistor R82, and driver Q19 to J8, rear connector P1-57, and to the bandwidth control circuit. Capacitor C21 filters the dc analog altitude voltage.

4.4.1.7.7 AID Enable (Refer to figure 4-25)

Aircraft installation delay (AID) is jumpered in the aircraft interconnect wiring harness to compensate for the time delays incorporated in the altimeter system by installation of the transmitter and receiver coaxial cables and the antenna height above the ground with the aircraft in touchdown configuration. Refer to paragraph 2.4.2 of the installation section for detailed information on AID. Correct AID is selected by jumpering P1-22, P1-24, or P1-27 to P1-19 (ground).

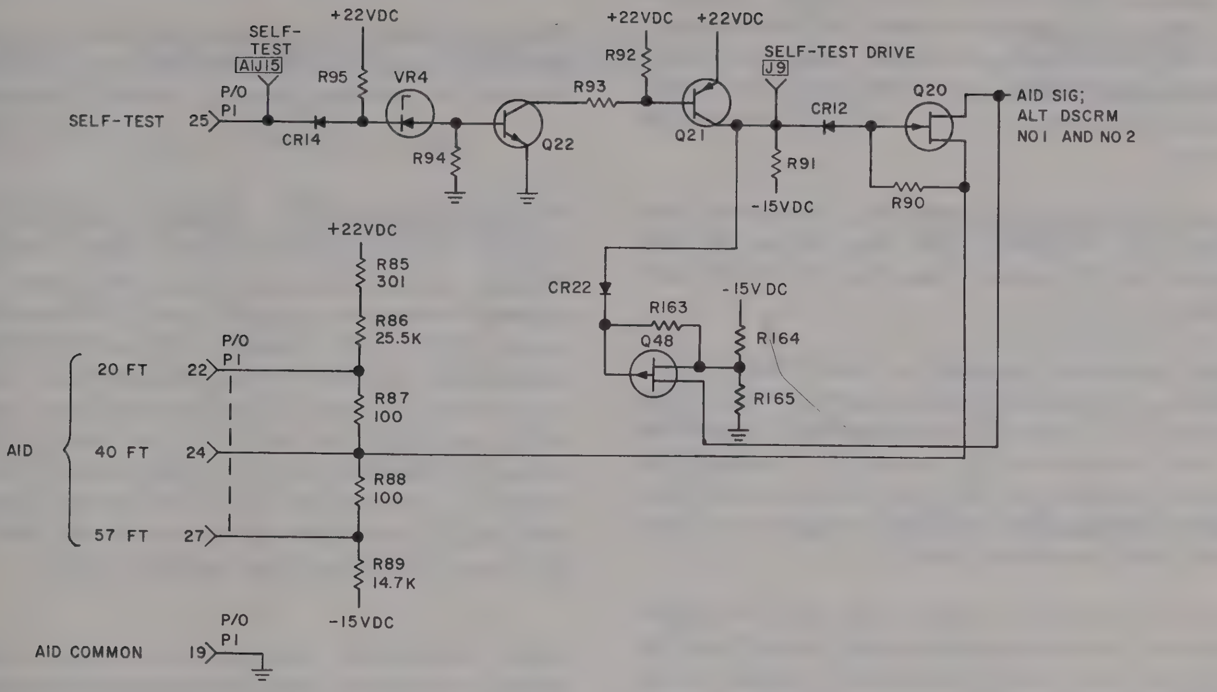
The AID bias is applied from voltage divider R85, R86, R87, R88, R89 to field-effect transistor Q20. When the system is not in self-test mode, the +22-V dc bias is applied through voltage divider R95, VR4, R94 to Q22. Transistor Q22 is forward biased and applies a ground to R93. Voltage divider R92, R93 applies a positive voltage to Q21, and Q21 is forward biased. Transistor Q21 applies +22 V dc to test point J9, diode CR12, and diode CR22. Diode CR12 is reverse biased; transistor Q20 turns on and applies the AID bias to altitude discriminator no 1 and altitude discriminator no 2 circuits. Diode CR22 is forward biased and applies reverse bias to Q48; transistor Q48 is turned off.

When self-test mode is selected, a ground is applied through P1-25 to A1J15 and through CR14 to VR4. Diode VR4 is reverse biased to less than its zener voltage, reverse biasing Q22; Q22 is cut off, removing ground from R93. Q21 is now reverse biased and turns off, causing test point J9 to become -9.4 V dc. CR12 is forward biased and Q20 is turned off, removing AID bias from altitude discriminator no 1 and altitude discriminator no 2 circuits. CR22 is reverse biased, and Q48 is turned on and applies self-test bias from voltage divider R164, R165 to altitude discriminator no 1 and altitude discriminator no 2 circuits.

4.4.1.7.8 FCS Warn (Refer to figure 4-26)

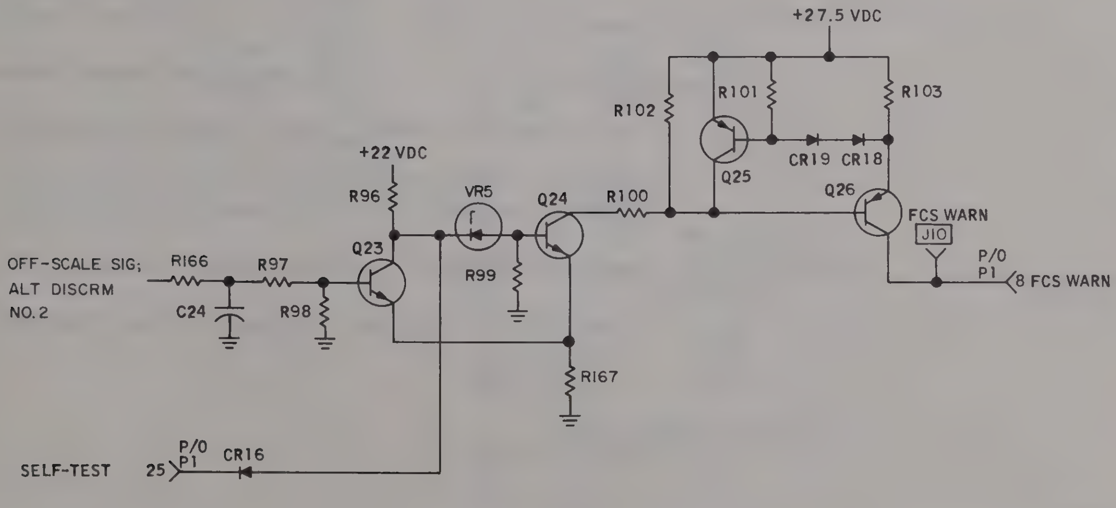
When the aircraft is below 2,000 feet and self-test mode is not selected, the +22-V dc bias is applied through voltage divider R96, VR5, R99 to Q24. Transistor Q24 is forward biased and applies a ground to R100 through R167. The +27.5-V dc power is applied through voltage divider R100, R102 to Q26. Transistor Q26 is forward biased and applies the +27.5-V dc power through R103 to J10 and rear connector P1-8 as an FCS warn voltage (no warn condition).

Transistor Q25 operates as a current limiter switch. Normally, Q25 is turned off because the drop across R103 is less than the nominal 1.2-volt drop across


SELF-
TEST
AIJ15
P/O
P1
SELF-TEST
25
CR14
+22VDC
R95
VR4
R94
Q22
R93
+22VDC
R92
+22VDC
Q21
SELF-TEST DRIVE
J9
CR12
R91
-15VDC
Q20
R90
AID SIG;
ALT DSCRM
NO1 AND NO2
+22VDC
R85
301
R86
25.5K
P/O
P1
20 FT
22
AID
40 FT
24
57 FT
27
R87
100
R88
100
R89
14.7K
-15VDC
P/O
P1
AID COMMON
19
CR22
R163
Q48
-15V DC
R164
R165

TP3-7230-013

P/O Altitude Processor A1, AID Enable Circuit, Simplified Schematic Diagram
Figure 4-25


+27.5 VDC
R102
R101
R103
Q25
CR19
CR18
Q26
FCS WARN
J10
P/O
P1
8 FCS WARN
+22 VDC
R96
VR5
Q24
R100
Q23
R99
OFF-SCALE SIG;
ALT DISCRM
NO.2
R166
R97
C24
R98
R167
SELF-TEST
25
P/O
P1
CR16

TP4-7761-013

P/O Altitude Processor A1, FCS Warn Circuit, Simplified Schematic Diagram
Figure 4-26

CR18 and CR19, plus the turn-on voltage of Q25. If the external FCS warn circuit draws excessive current, the voltage drop across R103 increases and CR18 and CR19 become forward biased. Transistor Q25 turns on and reduces the Q26 base drive. Under this condition, current to P1-8 is limited to nominal 160 mA.

If the +22-V dc power supply fails, transistor Q24 is turned off. Transistor Q26 then turns off and removes the FCS warn voltage from P1-8 (warn condition).

When the system is placed in the self-test mode, a ground is applied through rear connector P1-25 and CR16 to VR5. Diode VR5 is reverse biased to less than its zener voltage and Q24 turns off. Transistor Q24 removes the ground to R100 and Q26 turns off. Transistor Q26 removes the FCS warn voltage to rear connector P1-8 (warn condition).

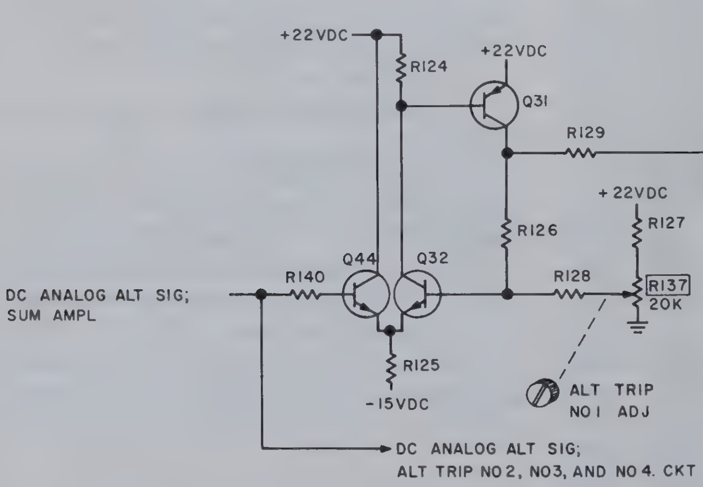
When the aircraft is above 2,000 feet and signal presence is lost, an off-scale voltage from altitude discriminator no 2 is applied through voltage divider R166, R97, R98 to Q23. Transistor Q23 turns on and applies a ground to VR5. Diode VR5 is reverse biased and Q24 turns off. Transistor Q24 removes the ground applied to R100. Transistor Q26 turns off and removes the FCS warn voltage to rear connector P1-8 (warn condition).

4.4.1.7.9 Altitude Trip (Refer to figure 4-27)

The four altitude trip circuits are identical except that each circuit is shop adjusted to a different altitude. Only altitude trip no 1 circuit is discussed.

The dc analog altitude voltage from the sum amplifier is applied through R140 to Q44. Transistor Q32 and Q44 operate as a voltage comparator. The reference voltage is applied from R137 in voltage divider R127, R137 through R128 to Q32. Potentiometer R137 is adjusted to set the reference voltage to a specific altitude. When the dc altitude analog voltage applied to Q44 exceeds the reference voltage applied to Q32, Q44 turns on and Q31 turns off. Transistor Q31 removes the +22 V dc applied through R129 to Q23. Transistor Q23 turns off and removes the ground to J11 and rear connector P1-41.

When the aircraft descends and the dc analog altitude voltage decreases to the reference voltage, Q32 turns on and forward biases Q31. Transistor Q31 turns on and applies +22 V dc through voltage divider R129, R130 to Q23. Transistor Q23 applies a ground to J11 and to rear connector P1-41.



NOTES:

① ALT TRIP NO1 CIRCUIT SHOWN AS TYPICAL ALT TRIP CIRCUIT.

② UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS.

TP3-7233-013

P/O Altitude Processor A1, Typical Altitude Trip Circuit, Simplified Schematic Diagram
Figure 4-27

Collins ALT-50 Radio Altimeter System (With ALT-50A for 2,000-Foot Operation)

Rockwell
International

maintenance

Collins General Aviation Division

Printed in USA

●523-0766823-105118
5th Edition, 15 January 1988
1st Revision, 22 July 1988

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Record of Revisions

RETAIN THIS RECORD IN THE FRONT OF MANUAL.
ON RECEIPT OF REVISIONS, INSERT REVISED PAGES IN THE MANUAL, AND ENTER DATE INSERTED AND INITIALS.

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5th Ed	15 Jan 88		None				
1	22 Jul 88		None				

section V maintenance

5.1 GENERAL

This section provides the information required to repair, maintain, test, and align the ALT-50A Radio Altimeter Receiver-Transmitter. Refer to the 339H4/4A Radio Altitude Indicator maintenance section (CPN 523-0764891) in this instruction book for maintenance and test procedures for the indicators. Refer to the 437X-1/1A/1B Antenna Instructions (CPN 523-0769099), ANT-50A Antenna Instructions (CPN 523-0769131), and ANT-52 Antenna Instructions (CPN 523-0773208) for maintenance and test procedures for the antennas. The ANT-50A procedures also may be used for the ANT-51A Antenna.

Table 5-1 is a list of tools required, and table 5-2 is a list of test equipment required, to accomplish testing, alignment, and repair of the ALT-50A.

Two test procedures are provided for the ALT-50A. The minimum performance test should be performed prior to installing the unit in the aircraft, and after any minor repairs have been completed. The minimum performance test is also used as a means of fault isolation. By using the minimum performance test in this way, the technician is able to select the applicable detailed test or alignment procedure in a minimum amount of time.

The detailed performance test and alignment procedures are provided for in-depth testing and alignment. Component layout and schematic diagrams with voltages and waveforms are contained in the diagrams section (section VI) of this instruction book. These diagrams should be used to supplement the test procedures. It is recommended that the minimum performance test be performed before the detailed performance test. By using this method, it is possible to quickly isolate faults to the appropriate board. Detailed performance testing and alignment procedures are then performed for that board.

5.2 SPECIAL TEST EQUIPMENT

Two test fixtures, three cables, and a transmitter dust cover (modified) must be fabricated in order to test and align the ALT-50A Radio Altimeter Receiver-Transmitter.

5.2.1 ALT-50A/55B Test Fixture

An ALT-50A/55B special test fixture is required to perform the test, troubleshooting, and adjustment procedures on the ALT-50A. The test fixture provides

Table 5-1. Tools Required.

DESCRIPTION	CHARACTERISTIC	FUNCTION
20-watt soldering iron	Any	Used to remove/replace IC's and components
Solder sucker	Any	Used to remove solder
Needle-nose pliers	Any	Used to bend component leads
Cutting tools	Various; small diagonal cutter, end nippers, etc (sharp tools that will not leave a burr)	Used to cut IC's and component leads
Adjustment tool	JFD 5284, or equivalent	Used to adjust variable resistors
Screwdrivers	Any	Used in disassembly/assembly
Adjustment tool	0.762-mm (0.030-in) square tuning tool, CPN 024-0799-010 (type 4093-D available from Johanson Mfg. Corp, Boonton, NJ)	Used for adjusting variable capacitors in transmitter A5

Table 5-2. Test Equipment Required.

DESCRIPTION	REQUIRED PARAMETER	SUGGESTED TYPE
Audio oscillator	Frequency: 450 Hz to 150 kHz Output: 0 to 10 V rms Impedance: 600 Ω	Hewlett-Packard, model 200CD
Frequency counter	Frequency: 0 to 150 kHz Voltage: 0 to 300 mV Error limit: ±0.1% Impedance: 100 kΩ	Hewlett-Packard, model 5212A/ Hewlett-Packard, model 5384A
Frequency meter	Range: 4.0 to 4.5 GHz Vswr: 1.3 max Insertion loss: 0.5 dB max off resonance Accuracy: ±0.10%	FXR N414A or General Microwave N608B
Digital voltmeter	Voltage: -16 to +30 V dc Increments: 0.001 V dc Error limit: ±0.1%	Hewlett-Packard, model 3439A/ 3443A or Fairchild model 7000 or Fluke 8000A
Ac vtvm	Voltage: 1 mV to 20 V ac	Hewlett-Packard model 400D
Test cables (two required)	Length: 13 ft, 2 inches dB loss: Must be calibrated	Locally fabricated (refer to paragraph 5.2.4)
Attenuators (two required)	Attenuation: 20 dB Frequency: 4.2 to 4.4 GHz Swr: 1.3 max Impedance: 50 Ω Power: 0.5 W max Error limit: ±0.5 dB	Narda, type 773-20
Variable attenuator	Attenuation: 0 to 30 dB Frequency: 4.2 to 4.4 GHz Swr: 2.0 max Impedance: 50 Ω Power: 0.5 W max Error limit: ±0.5%	ARRA, type 4-5414-30
Delay line	Time delay: 497 to 503 ns (must be calibrated) Attenuation: 39 dB nom Frequency: 4.2 to 4.4 GHz	Teledyne Mec, P/N M7416A, or equivalent
Thermistor mount		Hewlett-Packard, model 478A
Power meter	Frequency: 4.2 to 4.4 GHz Power: 100 mW	Hewlett-Packard, model 432A
ALT-50A/55B test fixture		Locally fabricated (refer to paragraph 5.2.1)
Transmitter/modulator/ modulator control test fixture and modulation adapter connector		Locally fabricated (refer to paragraph 5.2.2)
Transmitter alignment cover fixture		Locally fabricated (refer to paragraph 5.2.3)

Table 5-2. Test Equipment Required (Cont).

DESCRIPTION	REQUIRED PARAMETER	SUGGESTED TYPE
Oscilloscope		Tektronix, model 545/466
Crystal detector	Frequency: 4.2 to 4.4 GHz Frequency response: ±0.5 dB overall Maximum input: 100 mW Low-level sensitivity: 0.4 mV/μW Swr: 1.5 max	Hewlett-Packard, model 423A
Directional coupler	Frequency range: 4.2 to 4.4 GHz Impedance: 50 Ω Coupling: 30 dB	Narda 3004-30
Connector	Adapter for TNC to N to terminate unit into a 20-dB pad or 50-Ω termination	Selectro, part number 51-077-6701
Power supply	+17 to +34 V dc variable	

a means of applying inputs to rear connector P1 and of measuring results. The fixture also provides the necessary switching during testing and troubleshooting. Refer to figure 5-1 for a schematic diagram of the test fixture. The parts list for the fixture is included on the schematic. Figure 5-5 shows a suggested front-panel layout.

5.2.2 Transmitter/Modulator Test Fixture

A transmitter/modulator test fixture is required to adjust and troubleshoot transmitter A5, modulator A3, and modulator control A4. The fixture provides a means to apply power and obtain results during adjustment and troubleshooting of A3, A4, and A5. Refer to figure 5-2 for a schematic diagram of the test fixture. The parts list for the fixture is included on the schematic. Figure 5-10 shows a suggested front-panel layout.

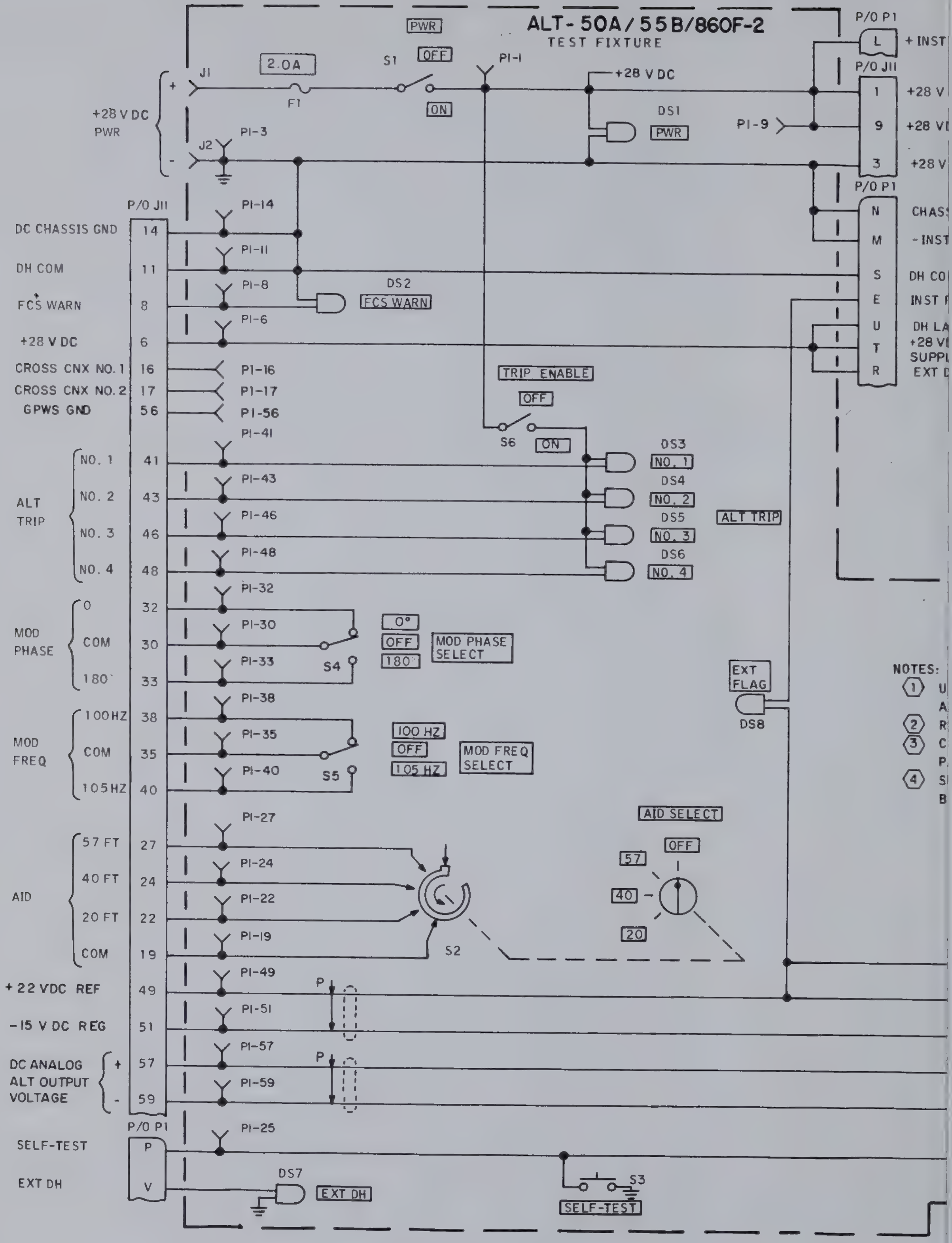
When troubleshooting modulator A3, modulator control A4 must be removed in order to provide access to modulator A3 components. A modulator adapter connector is required in order to connect the transmitter/modulator test fixture to modulator connector A3P1. The modulator adapter connector must be fabricated from a Collins thin-line connector strip, CPN 608-8763-001. Fabrication details are shown on figure 5-2.

Note

It is extremely important that pin 1 of the blue-line connector on the transmitter/modulator test fixture be properly identified. Refer to the modulator control A4 component location diagram in the diagrams section of this book, and note the pin numbering sequence on modulator control A4. Mark or otherwise identify pin 1 on the test fixture blue-line connector to ensure correct mating. This is important because absence of connector keying allows the connector to be installed either correctly or 180 degrees out.

5.2.3 Transmitter Alignment Dust Cover Fixture

A transmitter alignment dust cover fixture is required to provide access to adjustment screws and variable capacitors in the transmitter. A transmitter cover, CPN 618-1673-002, should be ordered and modified as shown in figure 5-3. After modification, ensure that all metal chips are removed from the cover before installing on a transmitter. After a transmitter is adjusted, ensure that the adjustment cover fixture is removed and the original cover is reinstalled to prevent dirt and moisture from entering the transmitter. To prevent loss, it is suggested that the adjustment cover fixture be marked ALT-50A/55B and chained or otherwise attached to the transmitter/modulator test fixture.


ALT-50A/55B/860F-2
TEST FIXTURE
PWR
OFF
ON
2.0A
F1
S1
J1
J2
PI-1
PI-3
+28 V DC
PWR
DS1
PI-9
P/O P1
L
+ INST
P/O J11
1
9
3
+28 V
+28 VI
+28 V
P/O P1
N
M
S
E
U
T
R
CHAS
- INST
DH CO
INST F
DH LA
+28 VI
SUPPL
EXT D
P/O J11
DC CHASSIS GND
14
PI-14
DH COM
11
PI-11
FCS WARN
8
PI-8
DS2
FCS WARN
+28 V DC
6
PI-6
CROSS CNX NO. 1
16
PI-16
CROSS CNX NO. 2
17
PI-17
GPWS GND
56
PI-56
TRIP ENABLE
OFF
ON
S6
ALT TRIP
NO. 1
41
PI-41
NO. 2
43
PI-43
NO. 3
46
PI-46
NO. 4
48
PI-48
DS3
NO. 1
DS4
NO. 2
DS5
NO. 3
DS6
NO. 4
ALT TRIP
MOD PHASE
0
32
PI-32
COM
30
PI-30
180
33
PI-33
S4
0°
OFF
180
MOD PHASE SELECT
MOD FREQ
100 HZ
38
PI-38
COM
35
PI-35
105 HZ
40
PI-40
S5
100 HZ
OFF
105 HZ
MOD FREQ SELECT
EXT FLAG
DS8
NOTES:
1
U
A
2
R
3
C
P
4
S
B
AID
57 FT
27
PI-27
40 FT
24
PI-24
20 FT
22
PI-22
COM
19
PI-19
S2
AID SELECT
OFF
57
40
20
+ 22 VDC REF
49
PI-49
-15 V DC REG
51
PI-51
P
DC ANALOG ALT OUTPUT VOLTAGE
+
57
PI-57
-
59
PI-59
P
P/O P1
SELF-TEST
P
PI-25
EXT DH
V
DS7
EXT DH
S3
SELF-TEST
LOC
LOC

ALT-50A/55B Special Test Fixture, Schematic Diagram
Figure 5-1

PARTS L
XMTR/M

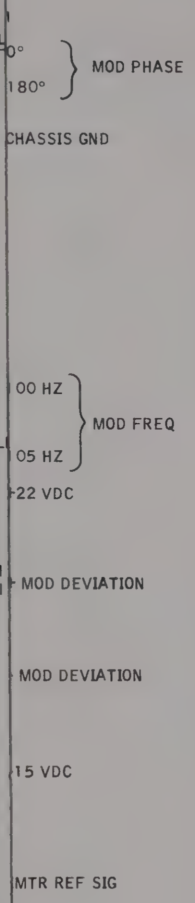
SYMBOL

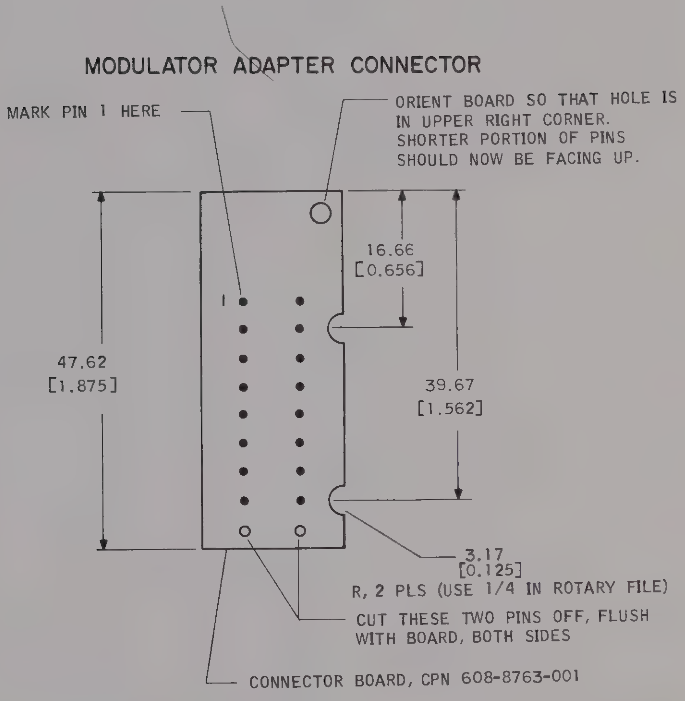
A8
C1
C2
J1
J2
J3
J4
J5
J6
J7
P1
None
R1
R2
S1
S2
S3
VR1
VR2

MISCEL

QTY

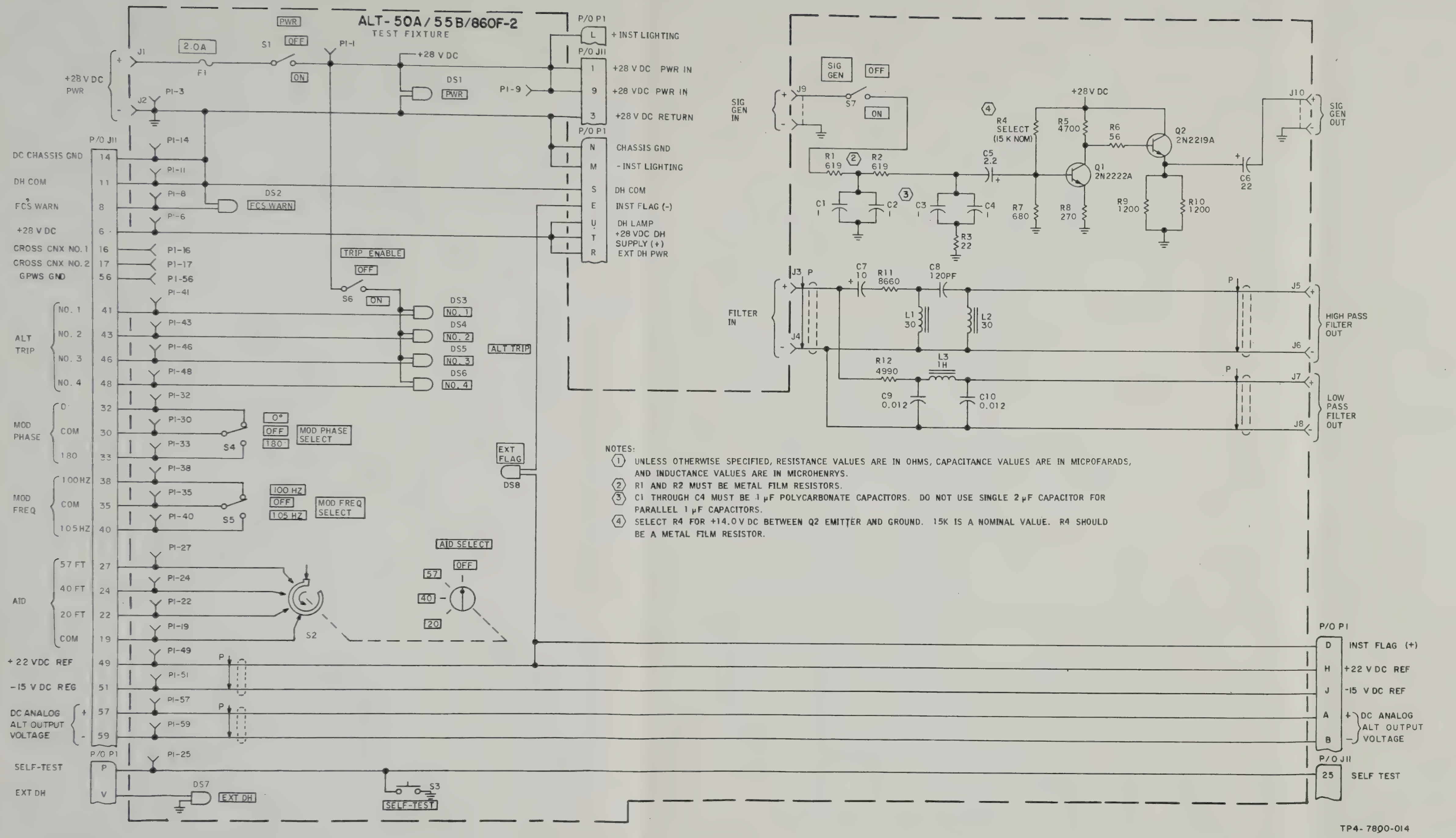
2
1
As reqd
As reqd


0°
180°
MOD PHASE
CHASSIS GND
00 HZ
05 HZ
MOD FREQ
22 VDC
MOD DEVIATION
MOD DEVIATION
15 VDC
MTR REF SIG


MODULATOR ADAPTER CONNECTOR
MARK PIN 1 HERE
ORIENT BOARD SO THAT HOLE IS IN UPPER RIGHT CORNER. SHORTER PORTION OF PINS SHOULD NOW BE FACING UP.
1
16.66 [0.656]
47.62 [1.875]
39.67 [1.562]
3.17 [0.125] R, 2 PLS (USE 1/4 IN ROTARY FILE)
CUT THESE TWO PINS OFF, FLUSH WITH BOARD, BOTH SIDES
CONNECTOR BOARD, CPN 608-8763-001

TP4-8460-014

Transmitter/Modulator Test Fixture and Modulator Adapter Connector, Schematic Diagram
Figure 5-2


ALT-50A/55B/860F-2
TEST FIXTURE
PWR
OFF
ON
S1
2.0A
F1
J1
J2
+28 V DC PWR
P1-1
P1-3
P1-9
+28 V DC
DS1
PWR
P/O P1
L
+ INST LIGHTING
P/O J11
1
+28 V DC PWR IN
9
+28 VDC PWR IN
3
+28 V DC RETURN
P/O P1
N
CHASSIS GND
M
- INST LIGHTING
S
DH COM
E
INST FLAG (-)
U
T
R
DH LAMP
+28 VDC DH SUPPLY (+)
EXT DH PWR
P/O J11
DC CHASSIS GND
14
P1-14
DH COM
11
P1-11
FCS WARN
8
P1-8
DS2
FCS WARN
+28 V DC
6
P1-6
CROSS CNX NO. 1
16
P1-16
CROSS CNX NO. 2
17
P1-17
GPWS GND
56
P1-56
TRIP ENABLE
OFF
ON
S6
ALT TRIP
NO. 1
41
P1-41
NO. 2
43
P1-43
NO. 3
46
P1-46
NO. 4
48
P1-48
DS3
NO. 1
DS4
NO. 2
DS5
NO. 3
DS6
NO. 4
ALT TRIP
MOD PHASE
0
COM
180
32
P1-32
30
P1-30
33
P1-33
S4
0°
OFF
180
MOD PHASE SELECT
MOD FREQ
100HZ
COM
105HZ
38
P1-38
35
P1-35
40
P1-40
S5
100 HZ
OFF
105 HZ
MOD FREQ SELECT
EXT FLAG
DS8
AID
57 FT
40 FT
20 FT
COM
27
P1-27
24
P1-24
22
P1-22
19
P1-19
S2
AID SELECT
OFF
57
40
20
+22 VDC REF
49
P1-49
-15 V DC REG
51
P1-51
DC ANALOG ALT OUTPUT VOLTAGE
+
-
57
P1-57
59
P1-59
P
P
P/O P1
SELF-TEST
P
P1-25
EXT DH
V
DS7
EXT DH
S3
SELF-TEST
SIG GEN
OFF
ON
S7
J9
SIG GEN IN
R1
619
②
R2
619
C1
1
C2
1
③
C3
1
C4
1
R3
22
C5
2.2
④
R4
SELECT
(15 K NOM)
+28V DC
R5
4700
R6
56
Q1
2N2222A
Q2
2N2219A
R7
680
R8
270
R9
1200
R10
1200
C6
22
J10
SIG GEN OUT
FILTER IN
J3
J4
P
C7
10
R11
8660
C8
120PF
L1
30
L2
30
R12
4990
L3
1H
C9
0.012
C10
0.012
J5
J6
HIGH PASS FILTER OUT
J7
J8
LOW PASS FILTER OUT
P/O P1
D
INST FLAG (+)
H
+22 V DC REF
J
-15 V DC REF
A
B
+
−
DC ANALOG ALT OUTPUT VOLTAGE
P/O J11
25
SELF TEST

NOTES:

① UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS, AND INDUCTANCE VALUES ARE IN MICROHENRYS.

② R1 AND R2 MUST BE METAL FILM RESISTORS.

③ C1 THROUGH C4 MUST BE 1 μF POLYCARBONATE CAPACITORS. DO NOT USE SINGLE 2 μF CAPACITOR FOR PARALLEL 1 μF CAPACITORS.

④ SELECT R4 FOR +14.0 V DC BETWEEN Q2 EMITTER AND GROUND. 15K IS A NOMINAL VALUE. R4 SHOULD BE A METAL FILM RESISTOR.

TP4-7800-014

ALT-50A/55B Special Test Fixture, Schematic Diagram
Figure 5-1

PARTS LIST
ALT-50A/55B RADIO ALTIMETER RECEIVER-TRANSMITTER
SPECIAL TEST FIXTURE

SYMBOL	DESCRIPTION	USED ON CODE	PART NUMBER	LOC
C1	Capacitor, fixed, polycarbonate, 1.0μF, 10%, 50V		933-1081-200	
C2	Capacitor, fixed, polycarbonate, 1.0μF, 10%, 50V		933-1081-200	
C3	Capacitor, fixed, polycarbonate, 1.0μF, 10%, 50V		933-1081-200	
C4	Capacitor, fixed, polycarbonate, 1.0μF, 10%, 50V		933-1081-200	
C5	Capacitor, fixed, tantalum, 2.2μF, 20%, 50V		184-9087-500	
C6	Capacitor, fixed, tantalum, 22μF, 10%, 35V		184-9086-660	
C7	Capacitor, fixed, tantalum, 10μF, 20%, 50V		184-9083-470	
C8	Capacitor, fixed, mica dielectric, 120pF, 5%, 500V		912-2822-000	
C9	Capacitor, fixed, mica dielectric, 12,000pF, 5%, 500V		912-2738-000	
C10	Capacitor, fixed, mica dielectric, 12,000pF, 5%, 500V		912-2738-000	
DS1	Lampholder and lens, red, pwr		262-2828-030	
DS2	Lampholder and lens, green, FCS warn		262-2828-020	
DS3	Lampholder and lens, white, alt trip 1		262-2828-050	
DS4	Lampholder and lens, white, alt trip 2		262-2828-050	
DS5	Lampholder and lens, white, alt trip 3		262-2828-050	
DS6	Lampholder and lens, white, alt trip 4		262-2828-050	
DS7	Lampholder and lens, yellow, ext DH		262-2828-010	
DS8	Lampholder and lens, red, ext flag		262-2828-030	
F1	Fuse, slow blow, 2.0A, 3AG		264-0305-000	
J1-	Binding post, twin, one red and one black post each		372-2240-010	
J8	(J1, J3, J5, and J7 are red, J2, J4, J6, and J8 are black)		(4 each reqd)	
J9-J10	Connector, bulkhead, type BNC		357-9670-000	
J11	Connector, thin-line, half high		634-1112-001	
None	Pins for connector J11, 29 reqd		372-2514-010	
L1	Choke, audio, 30mH		668-0396-000	
L2	Choke, audio, 30mH		668-0396-000	
L3	Choke, audio, 1.0H		668-0416-000	
P1	Connector, PT06A-14-19S		371-8087-000	
Q1	Transistor, 2N2222A		352-0661-020	
Q2	Transistor, 2N2219A		352-0661-010	
R1	Resistor, fixed, film, 619Ω, 1%, 1/8W		705-1454-340	
R2	Resistor, fixed, flim, 619Ω, 1%, 1/8W		705-1454-340	
R3	Resistor, fixed, composition, 22Ω, 5%, 1/8W		745-1863-090	
R4	Resistor, fixed, flim, select, 1%, 1/8W			
R5	Resistor, fixed, composition, 4700Ω, 10%, 1/4W		745-0773-000	
R6	Resistor, fixed, composition, 56Ω, 10%, 1/4W		745-0704-000	
R7	Resistor, fixed, composition, 680Ω, 10%, 1/4W		745-0743-000	
R8	Resistor, fixed, composition, 270Ω, 10%, 1/4W		745-0728-000	
R9	Resistor, fixed, composition, 1200Ω, 10%, 1/4W		745-0752-000	
R10	Resistor, fixed, composition, 1200Ω, 10%, 1/4W		745-0752-000	
R11	Resistor, fixed, film, 8660Ω, 1%, 1/8W		705-1470-850	
R12	Resistor, fixed, film, 4990Ω, 1%, 1/8W		705-1468-270	
S1	Switch, toggle, spst, pwr		266-5329-000	
S2	Switch, rotary wafer, 4-position, 1-pole, 1-section, AID select		259-9475-030	
S3	Switch, pushbutton, self-test		260-2722-000	
S4	Switch, toggle, spdt, mod freq select		266-5375-010	
S5	Switch, toggle, spdt, mod phase select		266-5375-010	
S6	Switch, toggle, spst, trip disable		266-5329-000	
S7	Switch, toggle, spst, sig gen		266-5329-000	

MISCELLANEOUS ITEMS

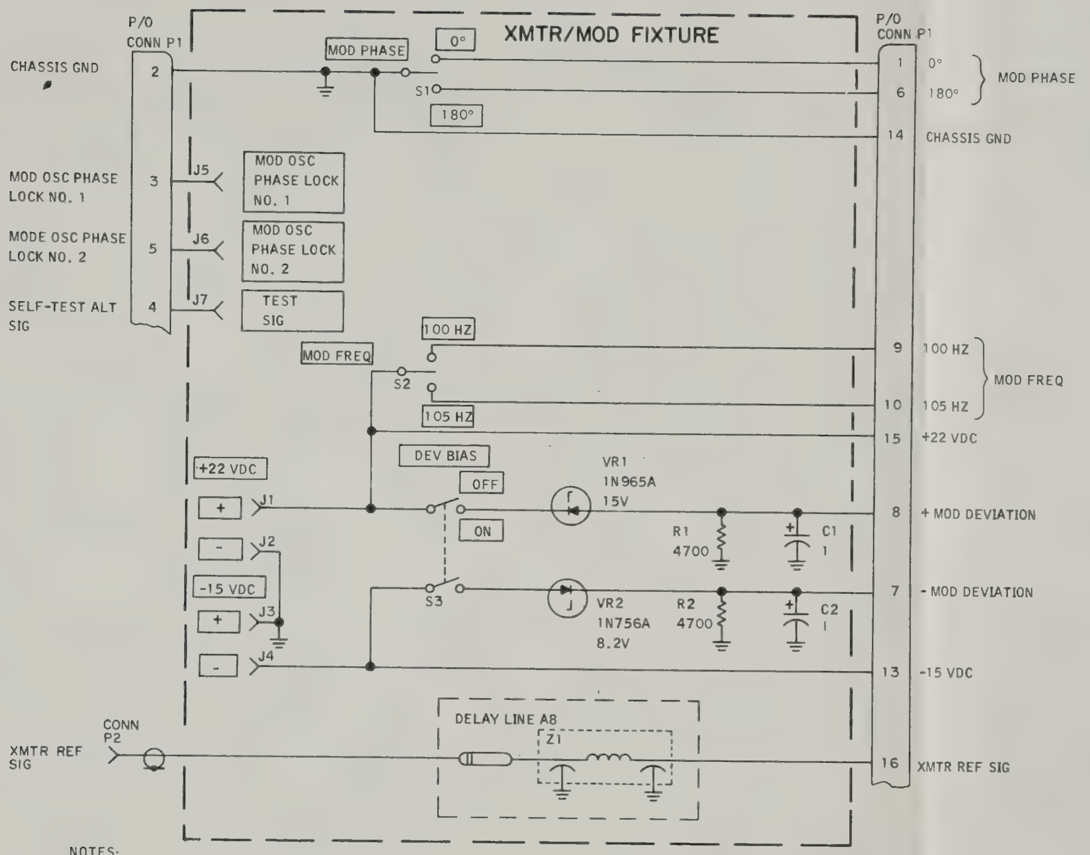
QTY	DESCRIPTION	USED ON CODE	PART NUMBER	LOC
29	Tip jacks, white		360-0149-000	
1	Fuseholder for 3AG fuse		265-1171-000	
8	Lamp, midget, flanged base, 28V		262-0179-010	
1	Chassis		Any	
2	Grommet, cable		Any	
As reqd	Wire, hookup, #24AWG, shielded and jacketed, twisted pair		Any	
As reqd	Wire, thermoplastic, #24AWG		Any	
As reqd	Cable, coaxial, RG-174/U		Any	

PARTS LIST
XMTR/MODULATOR TEST FIXTURE

SYMBOL	DESCRIPTION	USED ON CODE	COLLINS PART NUMBER	LOC
A8	Delay line		618-1672-001	
C1	Capacitor, fixed, tantalum, 1.0Ω F, 20%, 35V		184-9084-440	
C2	Capacitor, fixed, tantalum, 1.0Ω F, 20%, 35V		184-9084-440	
J1	Jack, red		372-1061-000	
J2	Jack, black		372-1062-000	
J3	Jack, red		372-1061-000	
J4	Jack, black		372-1062-000	
J5	Jack, yellow		360-0156-000	
J6	Jack, yellow		360-0156-000	
J7	Jack, white		360-0149-000	
P1	Connector, blue-line, 16-pin		372-2254-010	
None	Pins for connector P1, 14 reqd		372-2255-020	
R1	Resistor, fixed, composition, 4700Ω , 10%, 1/4W		745-0773-000	
R2	Resistor, fixed, composition, 4700Ω , 10%, 1/4W		745-0773-000	
S1	Switch, toggle, spst		266-3067-000	
S2	Switch, toggle, spst		266-3067-000	
S3	Switch, toggle, dpst		266-5171-000	
VR1	Zener diode, 1N965A, 15V		353-3176-000	
VR2	Zener diode, 1N756A, 8.2V		353-2720-000	

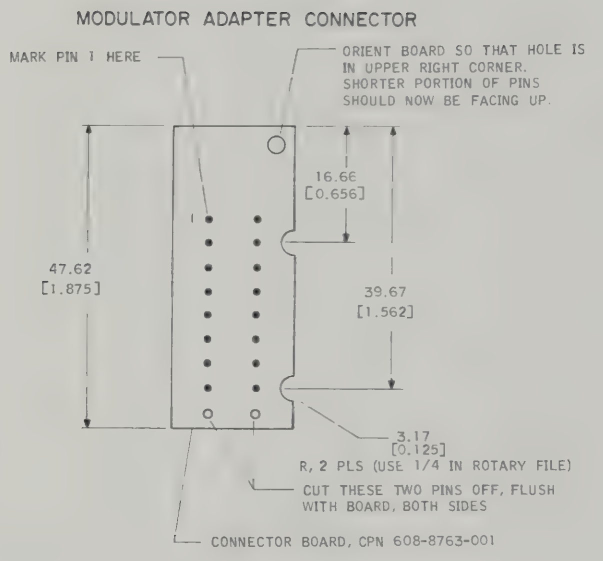
MISCELLANEOUS ITEMS

QTY	DESCRIPTION	USED ON CODE	COLLINS PART NUMBER	LOC
2	Grommet, cable		Any	
1	Chassis		Any	
As reqd	Wire, hookup, #24AWG		Any	
As reqd	Sleeving, cable		Any	


XMTR/MOD FIXTURE
P/O CONN P1
CHASSIS GND
2
MOD PHASE
0°
S1
180°
MOD OSC PHASE LOCK NO. 1
3
J5
MOD OSC PHASE LOCK NO. 1
MODE OSC PHASE LOCK NO. 2
5
J6
MOD OSC PHASE LOCK NO. 2
SELF-TEST ALT SIG
4
J7
TEST SIG
100 HZ
MOD FREQ
S2
105 HZ
+22 VDC
DEV BIAS
OFF
ON
J1
+
-
J2
-15 VDC
+
J3
-
J4
S3
VR1
1N965A
15V
R1
4700
C1
1
VR2
1N756A
8.2V
R2
4700
C2
1
CONN P2
XMTR REF SIG
DELAY LINE A8
Z1
P/O CONN P1
1
0°
6
180°
MOD PHASE
14
CHASSIS GND
9
100 HZ
10
105 HZ
MOD FREQ
15
+22 VDC
8
+ MOD DEVIATION
7
- MOD DEVIATION
13
-15 VDC
16
XMTR REF SIG

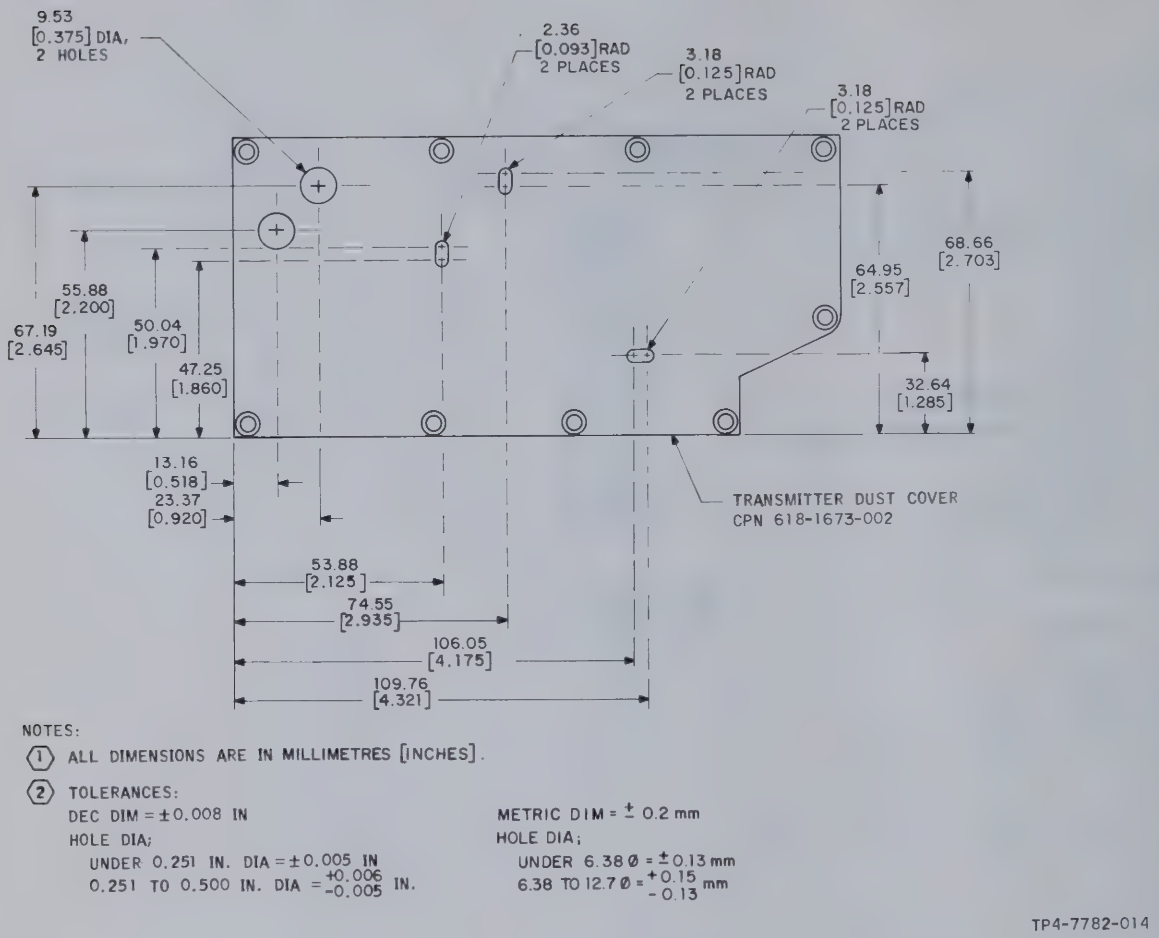
NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS.
2. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION, PREFIX WITH UNIT AND/OR ASSEMBLY DESIGNATION.
3 DIMENSIONS ARE IN MILLIMETERS [INCHES].


MODULATOR ADAPTER CONNECTOR
MARK PIN 1 HERE
ORIENT BOARD SO THAT HOLE IS IN UPPER RIGHT CORNER. SHORTER PORTION OF PINS SHOULD NOW BE FACING UP.
1
16.66 [0.656]
47.62 [1.875]
39.67 [1.562]
3.17 [0.125] R, 2 PLS (USE 1/4 IN ROTARY FILE)
CUT THESE TWO PINS OFF, FLUSH WITH BOARD, BOTH SIDES
CONNECTOR BOARD, CPN 608-8763-001

TP4-8460-014

Transmitter/Modulator Test Fixture and Modulator Adapter Connector, Schematic Diagram
Figure 5-2


9.53
[0.375] DIA,
2 HOLES
2.36
[0.093]RAD
2 PLACES
3.18
[0.125]RAD
2 PLACES
3.18
[0.125]RAD
2 PLACES
68.66
[2.703]
64.95
[2.557]
32.64
[1.285]
55.88
[2.200]
67.19
[2.645]
50.04
[1.970]
47.25
[1.860]
13.16
[0.518]
23.37
[0.920]
TRANSMITTER DUST COVER
CPN 618-1673-002
53.88
[2.125]
74.55
[2.935]
106.05
[4.175]
109.76
[4.321]
NOTES:
① ALL DIMENSIONS ARE IN MILLIMETRES [INCHES].
② TOLERANCES:
DEC DIM = ±0.008 IN
HOLE DIA;
UNDER 0.251 IN. DIA = ±0.005 IN
0.251 TO 0.500 IN. DIA = +0.006 -0.005 IN.
METRIC DIM = ± 0.2 mm
HOLE DIA;
UNDER 6.38 Ø = ±0.13 mm
6.38 TO 12.70 Ø = +0.15 -0.13 mm
TP4-7782-014

Transmitter Dust Cover Fixture for ALT-50A/55B
Figure 5-3

5.2.4 Special Test Cables

Two special rf test cables are required to test, troubleshoot, and adjust the ALT-50A. The cable fabrication is critical, and care must be used during fabrication. Handle the coaxial cable carefully to prevent crushing, distorting, or sharp bending. Table 5-3 lists the materials required to fabricate the two cables. Fabricate the two cables as follows:

a. Using 8-inch snap-cut pruning shears, cut two lengths of RG-214/U coaxial cable to exactly 13 feet, 2 inches. Make cut on straight section of cable.

Note

The 13-foot, 2-inch measurement is critical because of the time delay calibration requirement.

b. Install a TNC male connector on one end of each cable. Use standard shop practices for installation of TNC connectors.

c. Install a type N male connector on the opposite end of each test cable.

d. Calibrate decibel loss of each cable, and mark cables.

e. Time delay for 13 feet 2 inches of RG-214/U at 4300 MHz equals 20.28 ns.

Table 5-3. Special Test Cables, List of Materials.

QUANTITY	DESCRIPTION	COLLINS PART NUMBER
26 ft, 4 in	Cable, coaxial, RG-214/U	425-1532-000
2	Connector, TNC, male	357-7204-010
2	Connector, type N, male	357-9326-000

5.3 REPLACEMENT OF INTEGRATED CIRCUITS

Integrated circuits (IC's) are delicate items and should not be replaced until all other defects are eliminated and it is definitely determined that the IC is defective.

Before removal of the faulty IC, note its orientation on the board to ensure correct placement of the new component. Remove the old IC, using a solder sucker and needle-nose pliers to lift each lead. After the old IC has been removed, reheat each mounting hole and remove excess solder.

When soldering the new IC into place, avoid excessive heating. An excessive amount of heat may cause internal damage to the IC, making it inoperable. After soldering, use a toothpick to remove any heavy rosin deposits. Solder joints should be smooth, bright, and clean.

5.4 DISASSEMBLY/ASSEMBLY

The ALT-50A Radio Altimeter Receiver-Transmitter should be disassembled only when repair is necessary.

5.4.1 ALT-50A Radio Altimeter Receiver-Transmitter, Disassembly

Refer to the exploded view, figure 5-4, for guidance in disassembling the ALT-50A. Mark or otherwise identify all disconnected wiring. Make a note of color coding, wire dress, and methods of applying insulation (if used) before unsoldering or removing any electrical wire and/or part.

Caution

Do not attempt to disassemble the ALT-50A with the unit connected to the test fixture or any other source of power.

Note

While performing maintenance with the covers removed from this unit, service personnel are advised to observe standard safety precautions, such as wearing safety glasses, to prevent personal injury.

5.4.1.1 Removal of Dust Cover

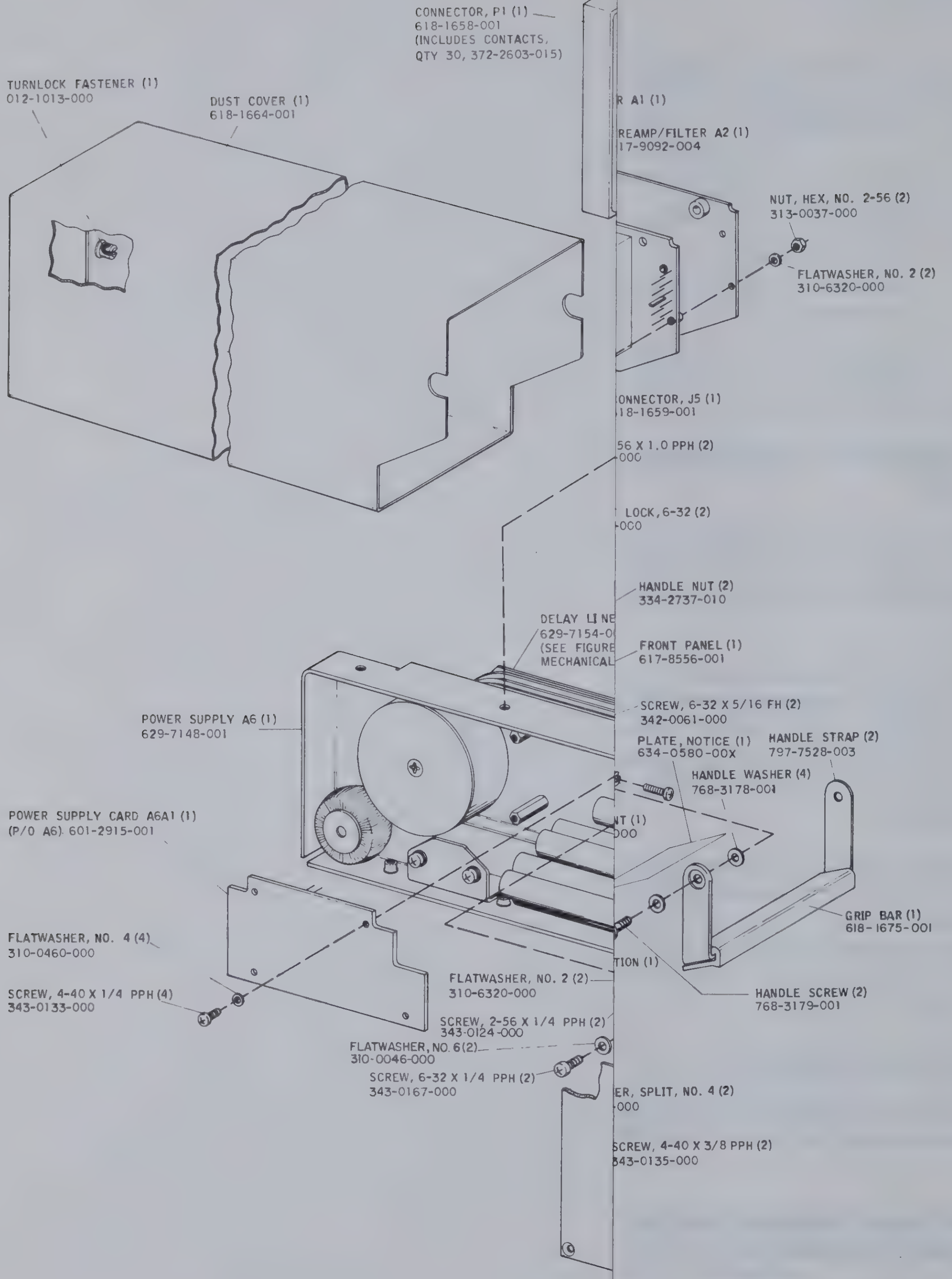
a. Loosen captive fastener located above rear connector P1.
b. Slide ALT-50A out of dust cover.

5.4.1.2 Removal of Altitude Processor A1 and Preamplifier/Filter A2

a. Remove six screws and flat washers that secure altitude processor A1 with attached preamplifier/filter A2 to chassis.
b. Carefully pull A1 with attached A2 from chassis, and disconnect connectors J4 and J5 from A2.
c. Remove four screws and flat washers that secure A1 to A2.
d. Separate A1 from A2 by disconnecting connector A1P1 from A2P1.

5.4.1.3 Removal of Modulator A3, Modulator A4, and Transmitter A5

a. Remove screw located at top left of front panel.
b. Remove top screw and lockwasher from holddown hook.
c. Remove two screws that secure transmitter A5 to power supply A6.
d. Carefully pull A5 with attached modulator A3 and modulator control A4 out of chassis.
e. Disconnect connector J4 from A4P1 and coaxial connector from delay line A8 from A5.
f. Remove A5 with attached A3 and A4.
g. Remove five screws and lockwashers that secure A4 to A3.
h. Disconnect connector A4P1 from A3P1, and remove modulator control A4.
i. Unsolder connections between A3 and A5, and remove modulator A3.


CONNECTOR, P1 (1)
618-1658-001
(INCLUDES CONTACTS,
QTY 30, 372-2603-015)
TURNLOCK FASTENER (1)
012-1013-000
DUST COVER (1)
618-1664-001
R A1 (1)
REAMP/FILTER A2 (1)
17-9092-004
NUT, HEX, NO. 2-56 (2)
313-0037-000
FLATWASHER, NO. 2 (2)
310-6320-000
ONNECTOR, J5 (1)
18-1659-001
56 X 1.0 PPH (2)
000
LOCK, 6-32 (2)
000
HANDLE NUT (2)
334-2737-010
DELAY LINE
629-7154-0
(SEE FIGURE
MECHANICAL
FRONT PANEL (1)
617-8556-001
SCREW, 6-32 X 5/16 FH (2)
342-0061-000
POWER SUPPLY A6 (1)
629-7148-001
PLATE, NOTICE (1)
634-0580-00X
HANDLE STRAP (2)
797-7528-003
HANDLE WASHER (4)
768-3178-001
POWER SUPPLY CARD A6A1 (1)
(P/O A6) 601-2915-001
NT (1)
000
GRIP BAR (1)
618-1675-001
FLATWASHER, NO. 4 (4)
310-0460-000
TION (1)
FLATWASHER, NO. 2 (2)
310-6320-000
HANDLE SCREW (2)
768-3179-001
SCREW, 4-40 X 1/4 PPH (4)
343-0133-000
SCREW, 2-56 X 1/4 PPH (2)
343-0124-000
FLATWASHER, NO. 6 (2)
310-0046-000
SCREW, 6-32 X 1/4 PPH (2)
343-0167-000
ER, SPLIT, NO. 4 (2)
000
SCREW, 4-40 X 3/8 PPH (2)
343-0135-000
TP4-9370-015

ALT-50A Radio Altimeter Receiver-Transmitter,
Exploded View
Figure 5-4

5.4.1.4 Removal of Delay Line A8

Tag and unsolder wires connected to delay line A8, and remove A8.

5.4.1.5 Removal of Mixer A7

a. Remove three screws located on bottom front of mixer A7 and three screws located on bottom rear of A7.
b. Slide back A7 to remove coaxial connectors from front panel, and remove A7.

5.4.2 ALT-50A Radio Altimeter Receiver-Transmitter, Assembly

Refer to the exploded view, figure 5-4, for guidance in assembling the ALT-50A.

5.4.2.1 Precautions and General Techniques

Caution

> When replacing a solid-state device, use a heat sink on the leads to prevent damage to the semiconductor.

a. Reconnect all wiring after installing each component or part. Before soldering any part or lead, refer to notes made during disassembly for color coding, placement of wires, and installation of insulation (if required).
b. All soldering must be performed in accordance with MIL-S-6872 using rosin-core solder, Federal Specification QQ-S-5716, composition Sn60.
c. Replace any defective wiring with wire of the same size and color coding.
d. Lace all wiring harnesses at 1/2-inch intervals and at breakout points.

5.4.2.2 Installation of Mixer A7

a. Slide coaxial connectors on mixer A7 in holes on front panel.
b. Install three screws on bottom front of A7 and three screws on bottom rear of A7 securing A7 to chassis.

5.4.2.3 Installation of Delay Line A8

Position delay line A8 in chassis, and solder connecting wires to A8.

5.4.2.4 Installation of Modulator A3, Modulator Control A4, and Transmitter A5

a. Install modulator A3 on transmitter A5, and solder connections between A3 and A5.
b. Install modulator control A4 on A3, and secure with five screws and lockwashers.
c. Connect connector J4 to A4P1.
d. Connect coaxial connector from delay line A8 to A5.
e. Carefully install A5 with attached A3 and A4 in chassis. Ensure that slip-on coaxial connector on mixer A7 connects with coaxial connector on A5.
f. Install screw in top left of front panel that secures A5 in chassis.
g. Install screw and lockwasher in top hole of hold-down hook that secures A5.
h. Install two screws that secure A5 to power supply A6.

5.4.2.5 Installation of Altitude Processor A1 and Preamplifier/Filter A2

a. Install altitude processor A1 on preamplifier/filter A2, and secure with four screws and flat washers.
b. Connect connector J5 to A2P1 and connector J4 to A2P2.
c. Install A2 with attached A1 in chassis, and secure with six screws and flat washers.

5.4.2.6 Installation of Dust Cover

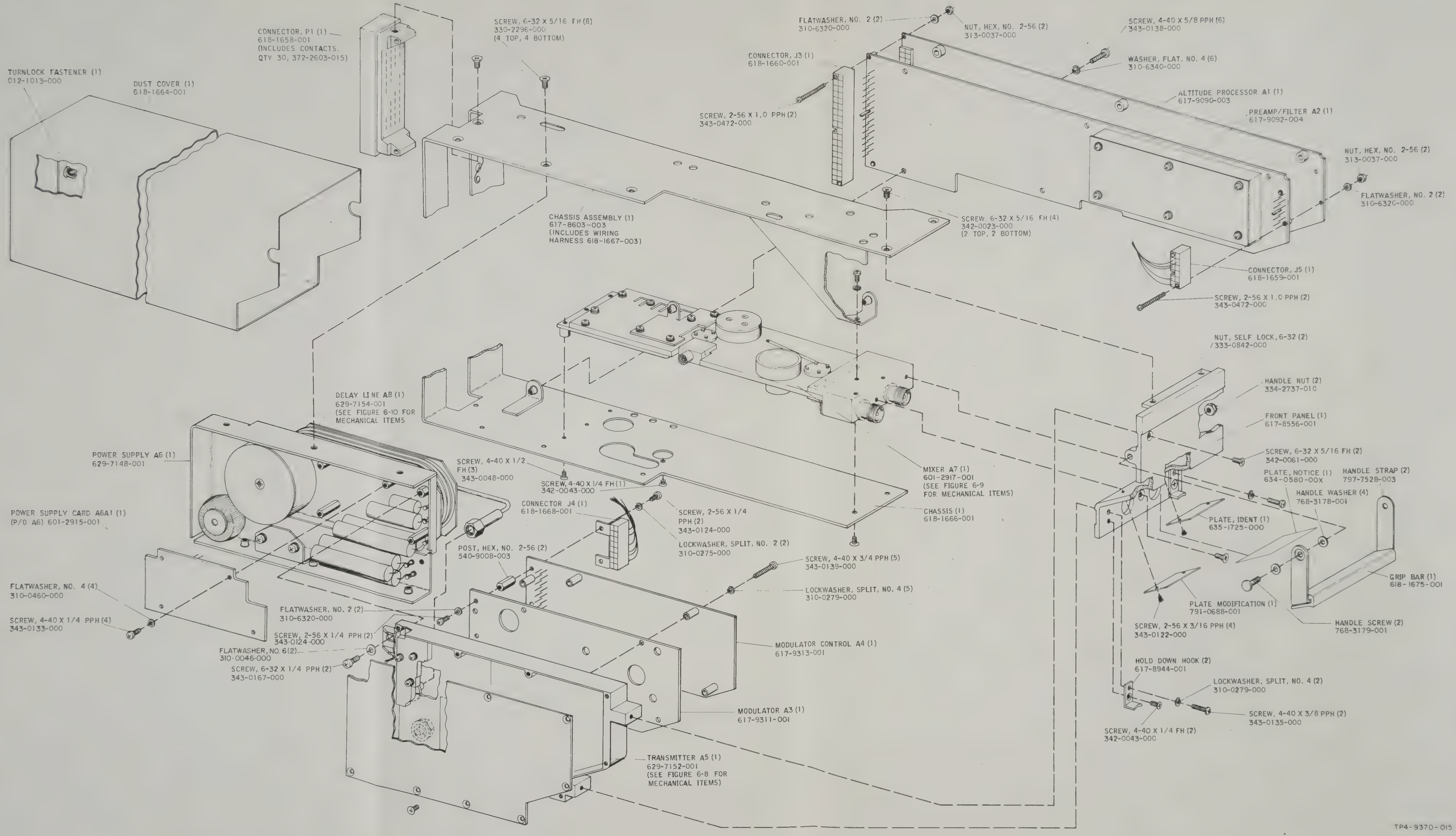
a. Slide ALT-50A into dust cover.
b. Tighten captive fastener located above rear connector P1.

5.5 ALT-50A RADIO ALTIMETER RECEIVER-TRANSMITTER REPAIR

If repair of planar subassemblies (circuit cards or sideboards) is to be attempted, request the document entitled Repair Instructions for Planar Assemblies and Cables, Collins part number 523-0763405. Send requests to Publications Department, Mail Station 106-181, Collins General Aviation Division, Rockwell International, Cedar Rapids, Iowa 52498.

5.6 TESTING, TROUBLESHOOTING, AND ALIGNMENT PROCEDURES

The final performance test, table 5-4, detailed performance test, table 5-7, and alignment/adjustment


TURNLOCK FASTENER (1)
012-1013-000
DUST COVER (1)
618-1664-001
CONNECTOR, P1 (1)
618-1658-001
(INCLUDES CONTACTS,
QTY 30, 372-2603-015)
SCREW, 6-32 X 5/16 FH (8)
330-2296-000
(4 TOP, 4 BOTTOM)
CHASSIS ASSEMBLY (1)
617-8603-003
(INCLUDES WIRING
HARNESS 618-1667-003)
FLATWASHER, NO. 2 (2)
310-6320-000
NUT, HEX, NO. 2-56 (2)
313-0037-000
SCREW, 4-40 X 5/8 PPH (6)
343-0138-000
CONNECTOR, J3 (1)
618-1660-001
WASHER, FLAT, NO. 4 (6)
310-6340-000
SCREW, 2-56 X 1.0 PPH (2)
343-0472-000
ALTITUDE PROCESSOR A1 (1)
617-9090-003
PREAMP/FILTER A2 (1)
617-9092-004
NUT, HEX, NO. 2-56 (2)
313-0037-000
FLATWASHER, NO. 2 (2)
310-6320-000
SCREW, 6-32 X 5/16 FH (4)
342-0023-000
(2 TOP, 2 BOTTOM)
CONNECTOR, J5 (1)
618-1659-001
SCREW, 2-56 X 1.0 PPH (2)
343-0472-000
NUT, SELF LOCK, 6-32 (2)
333-0842-000
HANDLE NUT (2)
334-2737-010
FRONT PANEL (1)
617-8556-001
SCREW, 6-32 X 5/16 FH (2)
342-0061-000
PLATE, NOTICE (1)
634-0580-00X
HANDLE STRAP (2)
797-7528-003
HANDLE WASHER (4)
768-3178-001
PLATE, IDENT (1)
635-1725-000
GRIP BAR (1)
618-1675-001
PLATE MODIFICATION (1)
791-0688-001
HANDLE SCREW (2)
768-3179-001
SCREW, 2-56 X 3/16 PPH (4)
343-0122-000
HOLD DOWN HOOK (2)
617-8944-001
LOCKWASHER, SPLIT, NO. 4 (2)
310-0279-000
SCREW, 4-40 X 3/8 PPH (2)
343-0135-000
SCREW, 4-40 X 1/4 FH (2)
342-0043-000
DELAY LINE A8 (1)
629-7154-001
(SEE FIGURE 6-10 FOR
MECHANICAL ITEMS
POWER SUPPLY A6 (1)
629-7148-001
POWER SUPPLY CARD A6A1 (1)
(P/O A6) 601-2915-001
SCREW, 4-40 X 1/2
FH (3)
343-0048-000
SCREW, 4-40 X 1/4 FH (1)
342-0043-000
CONNECTOR J4 (1)
618-1668-001
SCREW, 2-56 X 1/4
PPH (2)
343-0124-000
LOCKWASHER, SPLIT, NO. 2 (2)
310-0275-000
MIXER A7 (1)
601-2917-001
(SEE FIGURE 6-9
FOR MECHANICAL ITEMS)
CHASSIS (1)
618-1666-001
POST, HEX, NO. 2-56 (2)
540-9008-003
SCREW, 4-40 X 3/4 PPH (5)
343-0139-000
LOCKWASHER, SPLIT, NO. 4 (5)
310-0279-000
FLATWASHER, NO. 4 (4)
310-0460-000
SCREW, 4-40 X 1/4 PPH (4)
343-0133-000
FLATWASHER, NO. 2 (2)
310-6320-000
SCREW, 2-56 X 1/4 PPH (2)
343-0124-000
FLATWASHER, NO. 6 (2)
310-0046-000
SCREW, 6-32 X 1/4 PPH (2)
343-0167-000
MODULATOR CONTROL A4 (1)
617-9313-001
MODULATOR A3 (1)
617-9311-001
TRANSMITTER A5 (1)
629-7152-001
(SEE FIGURE 6-8 FOR
MECHANICAL ITEMS)
TP4-9370-015

ALT-50A Radio Altimeter Receiver-Transmitter,
Exploded View
Figure 5-4

5.4.1.4 Removal of Delay Line A8

Tag and unsolder wires connected to delay line A8, and remove A8.

5.4.1.5 Removal of Mixer A7

a. Remove three screws located on bottom front of mixer A7 and three screws located on bottom rear of A7.
b. Slide back A7 to remove coaxial connectors from front panel, and remove A7.

5.4.2 ALT-50A Radio Altimeter Receiver-Transmitter, Assembly

Refer to the exploded view, figure 5-4, for guidance in assembling the ALT-50A.

5.4.2.1 Precautions and General Techniques

> **Caution**
>
> When replacing a solid-state device, use a heat sink on the leads to prevent damage to the semiconductor.

a. Reconnect all wiring after installing each component or part. Before soldering any part or lead, refer to notes made during disassembly for color coding, placement of wires, and installation of insulation (if required).
b. All soldering must be performed in accordance with MIL-S-6872 using rosin-core solder, Federal Specification QQ-S-5716, composition Sn60.
c. Replace any defective wiring with wire of the same size and color coding.
d. Lace all wiring harnesses at 1/2-inch intervals and at breakout points.

5.4.2.2 Installation of Mixer A7

a. Slide coaxial connectors on mixer A7 in holes on front panel.
b. Install three screws on bottom front of A7 and three screws on bottom rear of A7 securing A7 to chassis.

5.4.2.3 Installation of Delay Line A8

Position delay line A8 in chassis, and solder connecting wires to A8.

5.4.2.4 Installation of Modulator A3, Modulator Control A4, and Transmitter A5

a. Install modulator A3 on transmitter A5, and solder connections between A3 and A5.
b. Install modulator control A4 on A3, and secure with five screws and lockwashers.
c. Connect connector J4 to A4P1.
d. Connect coaxial connector from delay line A8 to A5.
e. Carefully install A5 with attached A3 and A4 in chassis. Ensure that slip-on coaxial connector on mixer A7 connects with coaxial connector on A5.
f. Install screw in top left of front panel that secures A5 in chassis.
g. Install screw and lockwasher in top hole of hold-down hook that secures A5.
h. Install two screws that secure A5 to power supply A6.

5.4.2.5 Installation of Altitude Processor A1 and Preamplifier/Filter A2

a. Install altitude processor A1 on preamplifier/filter A2, and secure with four screws and flat washers.
b. Connect connector J5 to A2P1 and connector J4 to A2P2.
c. Install A2 with attached A1 in chassis, and secure with six screws and flat washers.

5.4.2.6 Installation of Dust Cover

a. Slide ALT-50A into dust cover.
b. Tighten captive fastener located above rear connector P1.

5.5 ALT-50A RADIO ALTIMETER RECEIVER-TRANSMITTER REPAIR

If repair of planar subassemblies (circuit cards or sideboards) is to be attempted, request the document entitled Repair Instructions for Planar Assemblies and Cables, Collins part number 523-0763405. Send requests to Publications Department, Mail Station 106-181, Collins General Aviation Division, Rockwell International, Cedar Rapids, Iowa 52498.

5.6 TESTING, TROUBLESHOOTING, AND ALIGNMENT PROCEDURES

The final performance test, table 5-4, detailed performance test, table 5-7, and alignment/adjustment procedure, table 5-8, for the ALT-50A Radio Altimeter Receiver-Transmitter are contained in this section. The minimum performance test should be used to test the ALT-50A prior to installation in the aircraft and can also be used as a fast check of the unit before or after overhaul.

Warning

Unless otherwise instructed, the transmitter terminal of the ALT-50A should be properly terminated. Failure to do so could result in serious damage to the equipment. It is also recommended that the receiver terminal be properly terminated.

Note

When checking transmitter power output, the cable loss and any attenuator loss must be added to the meter indication to obtain an accurate measurement.

5.6.1 ALT-50A Radio Altimeter Receiver-Transmitter, Test Setup

5.6.1.1 Power Requirements

a. A 0- to +35-V dc, ±10 percent, 1.5-A variable power supply is required to operate the ALT-50A during performance of the test, troubleshooting, and adjustment procedures.
b. A 0- to +30-V dc, ±10 percent, 500-mA variable power supply and a 0- to -15-V dc, ±10 percent, 100-mA variable power supply are required to perform modulator A3 and modulator control A4 troubleshooting and adjustment using the transmitter/modulator test fixture.

Table 5-4. ALT-50A Final Performance Test (Customer Acceptance Test).

STEP	PROCEDURE	DESIRED RESULTS
1.0	TEST SETUP Remove ALT-50A dust cover. Connect ALT-50A as shown in figure 5-5. Turn signal generator on and allow it to stabilize. Adjust 0- to +35-V dc power supply to +28.00 V dc. Test fixture setup: TRIP ENABLE OFF MOD FREQ SELECT 100 Hz MOD PHASE SELECT 0 degrees PWR ON SIG GEN OFF AID SELECT 40 Allow a 15-minute warmup of ALT-50A. Unless otherwise noted, standard input signal from signal generator is 2.4 V rms measured at SIG GEN OUT.	
2.0	POWER SUPPLY TEST	
2.1	+22.000 V dc check. Connect dvm to P1-49(+) and P1-14(-).	+21.940 to +22.060 V dc
2.2	-15.000 V dc check. Connect dvm to P1-51(+) and P1-14(-).	-14.940 to -15.060 V dc
3.0	AID AND ZERO-FOOT CALIBRATION TEST	
3.1	SIG GEN to ON. Signal generator to 870 Hz. Connect dvm P1-57(+) P1-59(-). Adjust generator output until FCS WARN lights.	+0.360 to +0.440 V dc
3.2	AID SELECT to 20. Signal generator to 470 Hz. Connect dvm P1-57(+) P1-59(-). Adjust generator output until FCS WARN lights.	+0.360 to +0.440 V dc

Table 5-4. ALT-50A Final Performance Test (Customer Acceptance Test) (Cont).

STEP	PROCEDURE	DESIRED RESULTS
3.3	AID SELECT to 57. Signal generator to 1210 Hz. Connect dvm P1-57(+) P1-59(-). Adjust generator output until FCS WARN lights.	+0.360 to +0.440 V dc
4.0	ALTITUDE VOLTAGE TEST	
4.1	AID SELECT to 40. Connect dvm P1-57(+) P1-59(-). Adjust signal generator to frequencies below. Adjust generator output until FCS WARN lights. Check dvm voltages to be within range listed in table 5-5.	
4.2	Signal generator to 150 kHz. Adjust generator output for maximum output.	+17.5 to +18.5 and FCS WARN is NOT lit.
5.0	ALTITUDE TRIP ADJUST TEST	
	Note Procedures in this test are for those units with factory adjusted altitude trips. If trips have been readjusted, refer to table 5-5 for dc analog altitude voltages, and use a plus or minus 5 percent difference.	
5.1	Adjust signal generator to 150 kHz. Adjust generator for 2.4 V rms output measured at SIG GEN OUT. TRIP ENABLE to ON. Decrease signal generator frequency until ALT TRIP NO. 4 indicator just lights.	+13.175 to +13.625 V dc (+13.400 V dc nominal)
5.2	Decrease signal generator frequency until ALT TRIP NO. 3 indicator just lights.	+11.750 to +12.050 V dc (+11.900 V dc nominal)
5.3	Decrease signal generator frequency until ALT TRIP NO. 2 indicator just lights.	+9.900 to +10.475 V dc (+10.400 V dc nominal)
5.4	Decrease signal generator frequency until ALT TRIP NO. 1 indicator just lights.	+4.200 to +4.600 V dc (+4.400 V dc nominal)
5.5	End receiver test: SIG GEN OFF TRIP ENABLE OFF PWR OFF Disconnect dvm	

Table 5-4. ALT-50A Final Performance Test (Customer Acceptance Test) (Cont).

STEP	PROCEDURE	DESIRED RESULTS
6.0	TRANSMITTER TEST	
	TEST SETUP Connect ALT-50A to test equipment as shown in figure 5-7, TRANSMITTER A5, TEST SETUP. Test fixture setup: TRIP ENABLE OFF MOD FREQ SELECT 100 Hz MOD PHASE SELECT 0 degrees PWR ON SIG GEN OFF AID SELECT 40 Allow 15 minutes for warmup. **Note** During the following test the wobbulation is not inhibited. During the measurement of end-point frequencies, the spikes will rapidly move back and forth, making an accurate test difficult. The following test serves to verify that the transmitter frequency is within reasonable limits. When adjusting the frequency meter close to the end-point frequencies it will be possible to make the spike disappear for most of the time or to remain in view most of the time. It is desirable for purposes of these tests to adjust the frequency meter for a compromise setting in which the spike is in view for approximately half the time.	
6.1	Check power meter indication. **Note** When checking transmitter power output, the cable loss must be added to the meter indication to obtain an accurate measurement.	210 milliwatts minimum, allowing for cable loss.
6.2	Adjust frequency meter downward from 4300 MHz until point at which spike begins to disappear. Record frequency meter indication. Increase frequency meter until spike begins to disappear. Record frequency meter indication.	Compute the sum of the two recorded frequencies and divide by two. Verify result within 4300 ±5 MHz.
7.0	RF LOOP TEST	
	TEST SETUP Connect ALT-50A as shown in figure 5-8. Test fixture setup: TRIP ENABLE OFF MOD FREQ SELECT 100 Hz MOD PHASE SELECT 0 degrees PWR OFF SIG GEN OFF AID SELECT 40	
7.1	Calculate total dB loss of rf loop including cables, excluding variable attenuator. Adjust variable attenuator to make total decibel loss of rf loop equal 96 dB. (Total rf loop dB loss = xmit cable dB loss + 20 dB attenuator + variable attenuator + second 20 dB attenuator + receiver cable dB loss.)	Total rf loop loss = 96 dB

Table 5-4. ALT-50A Final Performance Test (Customer Acceptance Test) (Cont).

STEP	PROCEDURE	DESIRED RESULTS
7.2	Calculate total time delay of rf loop, and record total time delay. (Total time delay = xmit cable time delay + 20 dB attenuator time delay + variable attenuator time delay + second 20 dB attenuator time delay + receiver cable time delay.)	Calculate total time delay.
7.3	Connect dvm between P1-57 (+) and P1-59 (–). PWR to ON.	Check dvm indication and compare with dvm indication listed in table 5-6 for time delay recorded in step 7.2.
7.4	MOD FREQ SELECT 105Hz. MOD PHASE SELECT 0 degrees.	Check dvm indication and compare with dvm indication listed in table 5-6 for time delay recorded in step 7.2.
8.0	SELF-TEST TEST	
	TEST SETUP Connect ALT-50A as shown in figure 5-5. Test fixture setup: TRIP ENABLE OFF MOD FREQ SELECT 100 Hz MOD PHASE SELECT 0 degrees PWR ON SIG GEN OFF AID SELECT 40	
8.1	Connect dvm to P1-57 (+) and P1-59 (–). Depress SELF-TEST	dvm = +1.360 to +1.440 V dc
9.0	POSTTEST PROCEDURE	
9.1	PWR to OFF. Disconnect ALT-50A from test setup. Install ALT-50A dust cover.	

Table 5-5. Altitude Voltage Chart.

SIG GEN FREQ (Hz)	ALTITUDE (ft)	DVM INDICATION (V dc)
4,870	100	+2.360 to +2.440
8,870	200	+4.320 to +4.480
12,870	300	+6,280 to +6,520
16,870	400	+8.240 to +8,560
20,870	500	+10.200 to +10.430
40,870	1,000	+11.840 to +11.960
60,870	1,500	+13.310 to +13.490
80,870	2,000	+14.780 to +15.020

Table 5-6. 350-Foot Altitude Accuracy Voltages.

RF LOOP DELAY TIME (ns)	DVM INDICATION (V dc)
541.9	+5.232 to +5.432
542.4	+5.237 to +5.437
542.9	+5.242 to +5.442
543.4	+5.247 to +5.447
543.9	+5.252 to +5.452
544.4	+5.257 to +5.457
544.9	+5.262 to +5.462
545.4	+5.267 to +5.467
545.9	+5.272 to +5.472
546.4	+5.277 to +5.477
546.9	+5.281 to +5.481
547.4	+5.286 to +5.486
547.9	+5.291 to +5.491
548.4	+5.296 to +5.496
548.9	+5.301 to +5.501
549.4	+5.306 to +5.506
549.9	+5.311 to +5.511
550.4	+5.316 to +5.516
550.9	+5.321 to +5.521

Dvm indications are calculated using the following formula:

1. Dvm ind = 9.84 x rf loop delay time in microseconds.
2. Rf loop delay time = total time delay from XMTR J1 connector on ALT-50A to RCVR J2 connector.

Table 5-7. ALT-50A Detailed Performance Test.

STEP	PROCEDURE	DESIRED RESULTS	TROUBLESHOOTING SUGGESTIONS
1.0	TEST SETUP Remove ALT-50A dust cover. Connect ALT-50A as shown in figure 5-5. Turn signal generator on and allow it to stabilize. Adjust 0- to +35-V dc power supply to +28.00 V dc. Test fixture setup: TRIP ENABLE OFF MOD FREQ SELECT 100 Hz MOD PHASE SELECT 0 degrees PWR ON SIG GEN OFF AID SELECT 40 Allow a 15-minute warmup of ALT-50A. Unless otherwise specified, the standard signal from the signal generator is 2.4 V rms measured at SIG GEN OUT. ***Troubleshooting Note*** The power supply adjustment procedure described in table 5-8 steps 2.1 through 2.4 should be performed before troubleshooting the circuits to ensure correct adjustment unless a visual examination reveals defective components.		

Table 5-7. ALT-50A Detailed Performance Test (Cont).

STEP	PROCEDURE	DESIRED RESULTS	TROUBLESHOOTING SUGGESTIONS
2.0	POWER SUPPLY TEST		
2.1	Connect dvm P1-6 (+) and P1-14 (–).	+27.0 to +27.5 V dc	Check A6L101, A6CR101, A6C101,A6C102, and A6C103 circuits.
2.2	Connect dvm A6J2 (+) and P1-14 (–).	+26.3 to +28.3 V dc	Check A6U201, A6U203, A6U202, A6Q201, A6Q202, and A6Q101 circuits.
2.3	Connect dvm P1-49 (+) and P1-14 (–).	+21.94 to +22.06 V dc	Check +22 V dc regulator circuit A6Q102 and A6U101.
2.4	Connect dvm P1-51 (+) and P1-14 (–).	-14.94 to -15.06 V dc	Check -15 V dc regulator circuit A6Q103 and A6U102.
2.5	Decrease 0- to +35-V dc power supply to +22.00 V dc. Connect dvm P1-49 (+) and P1-14 (–).	+21.94 to +22.06 V dc	Check A6U202, A6Q203, A6U203, A6Q102, and A6U101 circuits.
2.6	Connect dvm P1-51 (+) and P1-14 (–).	–14.94 to –15.06 V dc	Check A6Q103, and A6U102 circuits.
2.7	Turn 0- to +35-V dc power supply off. Delay 1 second minimum, then turn 0- to +35-V dc power supply on. Connect dvm P1-49 (+) and P1-14 (–).	+21.94 to +22.06 V dc	Check A6U202 and A6Q203 circuits.
2.8	Decrease 0- to +35-V dc power supply to +17.00 V dc. Connect dvm P1-49 (+) and P1-14 (–).	Nominal 0 V dc	Check A6U202 and A6Q203 circuits.
2.9	Increase 0- to +35-V dc power supply to +34.00 V dc. Connect dvm P1-49 (+) and P1-14 (–).	+21.94 to +22.06 V dc	Check +22 V dc regulator circuit A6Q102 and A6U101.
2.10	Connect dvm P1-51 (+) and P1-14 (–).	–14.94 to –15.06 V dc	Check –15 V dc regulator circuit A6Q103 and A6U102.
2.11	Decrease 0- to +35-V dc power supply to +28.00 V dc. Using an oscilloscope, measure ac ripple at P1-49.	Ac ripple not to exceed 50 mV ac.	Check A6C109 and A6C110 circuits.
2.12	Using an oscilloscope, measure ac ripple at P1-51.	Ac ripple not to exceed 50 mV ac.	Check A6C113 and A6C114 circuits.
2.13	Turn 0- to +35-V dc power supply off. Connect a 1-ohm, 5-watt resistor between P1-49 and P1-14. Turn on 0- to +35-V dc power supply. Connect dvm P1-49 (+) and P1-14 (–).	+0.76 to +1.03 V dc	Check A6U101 circuit.
2.14	Turn 0- to +35-V dc power supply off. Move the 1-ohm, 5-watt resistor from P1-49 and P1-14 to P1-51 and P1-14. Turn on 0- to +35-V dc power supply. Connect dvm P1-51 (+) and P1-14 (-).	–0.13 to –0.17 V dc	Check A6U102 circuit.
2.15	End power supply test. Turn 0- to +35-V dc power supply off. Remove the 1-ohm, 5-watt resistor from P1-51 and P1-14. Remove dvm.		

Table 5-7. ALT-50A Detailed Performance Test (Cont).

STEP	PROCEDURE	DESIRED RESULTS	TROUBLESHOOTING SUGGESTIONS
3.0	MODULATION TEST		
	TEST SETUP Connect as per step 1.0 Test fixture setup: TRIP ENABLE OFF MOD FREQ SELECT 100 Hz MOD PHASE SELECT 0 degrees PWR ON SIG GEN OFF AID SELECT 40 ***Troubleshooting Note*** Troubleshooting of modulator A3 and modulator control A4 cannot be performed with the modules installed in the ALT-50A. The modules must be removed and connected to the transmitter/modulator test fixture as shown in figure 5-10. Ensure that the transmitter output is loaded by connecting a 20-dB pad to A5J2. Remove transmitter A5/modulator control A4/modulator A3 assembly from the ALT-50A as described in disassembly paragraph 5.4.1.3, and reinstall as described in assembly paragraph 5.4.2.4. When troubleshooting modulator A3, remove modulator control A4 to provide access to A3 as described in disassembly paragraph 5.4.1.3, steps g and h. Reinstall A4 as described in assembly paragraph 5.4.2.4, step b. When A4 is removed, a modulator adapter connector must be installed in A3P1 to provide mating connection for the test fixture connector, and the test fixture MOD CONT VDC switch must be set to ON. Refer to figure 5-2.		
3.1	Using an oscilloscope, check waveform at A4J1	Compare with waveform in figure 5-6 view A.	Check filter/amplifier A4U1 and A4U2 circuits.
3.2	Using a frequency counter, measure frequency at P1-17.	99 to 101 Hz	Reselect A3R41 as per table 5-8 step 4.1. Check A3Q8, A3Q17, A3Q13, A3Q14, and A3U5 circuits.
3.3	MOD FREQ SELECT to 105 Hz. Measure frequency at P1-17.	104 to 106 Hz	Check A3Q8, A3Q17, and A3U5 circuits.
3.4	MOD FREQ SELECT to 100 Hz. Connect scope trigger to P1-16. Connect scope to A3J3.	Check waveform for amplitude jitter. Jitter indicates wobbulation is OK. Compare waveform with figure 5-6 view B.	Check A4Q6 and A4Q7 circuits. Check A3Q9, A3Q10, A3Q11, A3U6, A4Q1, A4Q2, A4Q3, A4Q4 A4Q5, A4U3, A4U4, and A3Q14.
3.5	MOD PHASE SELECT to 180 degrees. With scope trigger connected to P1-16, check waveform at A3J3.	Compare waveform with figure 5-6 view C.	Check A3Q14 circuit.
3.6	End modulator test. Disconnect oscilloscope. PWR to OFF.		

Table 5-7. ALT-50A Detailed Performance Test (Cont).

STEP	PROCEDURE	DESIRED RESULTS	TROUBLESHOOTING SUGGESTIONS
4.0	TRANSMITTER TEST		
	TEST SETUP Connect ALT-50A as per figure 5-7, TRANSMITTER A5, TEST SETUP. Adjust frequency meter to 4300 MHz. Test fixture setup: TRIP ENABLE OFF MOD FREQ SELECT 100 Hz MOD PHASE SELECT 0 degrees PWR ON SIG GEN OFF AID SELECT 40 ***Troubleshooting Note*** Perform the transmitter alignment procedure as described in table 5-8 steps 3.0 through 3.21 before troubleshooting transmitter circuits.		
4.1	With power meter connected, measure power output.	210 mW minimum, allowing for cable loss	Check A5Q2 and A3Q16 circuits.
4.2	Jumper A4J4 to ground. Adjust frequency meter downward from 4300 MHz until the point at which the spike begins to disappear. Record frequency meter indication. Increase frequency meter until the spike begins to disappear. Record frequency meter indication. Compute the sum of the two recorded frequencies and divide by 2.	4300 ±5 MHz	Check A5Q1, A5CR1, A5CR2, A3Q15, A4U3, and A4U4 circuits. (Jumper to A4J4 disables wobbulation circuit.)
4.3	Using the recorded frequencies in step 4.2, compute the difference between the two recorded frequencies.	96 to 100 MHz	Check A5Q1, A5CR1, A5CR2, A3Q15, A4U3, and A4U4, circuits.
4.4	With the frequency meter at one of the recorded frequencies, remove A4J4 jumper.	Verify jitter of the spike begins when the jumper is removed.	Check wobbulation circuit. Jitter indicates wobbulation circuit is OK.
4.5	Connect scope trigger to A3J2. Connect scope probe to A2J4. Adjust variable attenuator for a total loop loss of 96 dB.	Check that no discontinuities appear in the waveform envelope.	
4.6	End transmitter test. PWR to OFF. Disconnect scope from A2J4 and scope trigger from A3J2.		
5.0	SIGNAL PRESENCE THRESHOLD TEST		
	TEST SETUP Connect ALT-50A to rf loop as shown in figure 5-8. Test fixture setup: TRIP ENABLE OFF MOD FREQ SELECT 100 Hz MOD PHASE SELECT 0 degrees PWR ON SIG GEN OFF AID SELECT 40		

Table 5-7. ALT-50A Detailed Performance Test (Cont).

STEP	PROCEDURE	DESIRED RESULTS	TROUBLESHOOTING SUGGESTIONS
5.1	Calculate the total rf loop decibel loss as shown on figure 5-8, and adjust variable attenuator to make total rf loop decibel loss equal 102 dB.	Check that FCS WARN indicator is not lit. If indicator is lit, adjust A2R114 until indicator just goes out.	Check signal presence detector A2Q32, A2Q33, A2Q34, and A2Q39 circuit.
5.2	Adjust variable attenuator to make the total rf loop decibel loss equal 96 dB.	Check that FCS WARN indicator is lit.	Check signal presence detector A2Q32, A2Q33, A2Q34, and A2Q39 circuit.
5.3	With variable attenuator set as per step 5.2, connect dvm to A2J2 (+) and chassis (-).	Nominal -4 V dc	
5.4	With variable attenuator set as per step 5.2, connect dvm to A2J3 (+) and chassis (-).	Nominal -4 V dc	
5.5	End signal presence threshold test. PWR to OFF.		
6.0	RECEIVER GAIN, FREQUENCY RESPONSE, AND NOISE TEST		
	Use test setup in step 5.0. (No setup required if following step 5.5.)		
6.1	Adjust variable attenuator for total rf loop loss of 96 dB. Measure and record ac volts at A2J4. PWR to OFF. Connect ALT-50A per figure 5-5. SIG GEN to ON. PWR to ON. Adjust signal generator to 10 kHz. Connect ac vtvm to A2J4. Adjust signal generator output level until vtvm indication equals recorded ac voltage. Adjust signal generator frequency to 82 kHz. Observe the vtvm while decreasing the signal generator to 400 Hz.	The voltage must not vary more than ±6 dB from recorded ac voltage.	Check preamplifier A2Q1, A2Q2 A2Q3, and A2Q4. Check low-pass filter A2Q5 through A2Q13. Check postamplifier A2Q14 through A2Q17.
6.2	With signal generator level set as per step 6.1, while observing FCS WARN adjust signal generator from 400 Hz to 82 kHz.	Observe FCS WARN is lit through the entire frequency range.	Check preamplifier A2Q1, A2Q2, A2Q3, and A2Q4. Check low-pass filter A2Q5 through A2Q13. Check postamplifier A2Q14 through A2Q17.
6.3	SIG GEN to OFF. Disconnect ac vtvm from A2J4. Connect scope to A2J4 and measure peak-to-peak noise.	Voltage must not exceed 3 volts peak-to-peak.	Check low-pass filter A2Q5 through A2Q13.
7.0	HIGH-FREQUENCY CUTOFF TEST		
	TEST SETUP Connect ALT-50A to test equipment as shown in figure 5-5. Test fixture setup: TRIP ENABLE OFF MOD FREQ SELECT 100 Hz MOD PHASE SELECT 0 degrees PWR ON SIG GEN OFF AID SELECT 40 (No setup required if following step 6.3.)		

Table 5-7. ALT-50A Detailed Performance Test (Cont).

STEP	PROCEDURE	DESIRED RESULTS	TROUBLESHOOTING SUGGESTIONS
7.1	SIG GEN to ON. Adjust signal generator frequency to 100.8 kHz. Adjust signal generator output level for 6 mV ac at A2J1. Connect dvm to P1-57 (+) and P1-59 (-).	Check for +16.2 to +16.6 V dc. Check that FCS WARN indicator is lit.	Check altitude discriminator adjustment. Check FCS warn A1Q23, A1Q24, A1Q25, and A1Q26 circuit.
7.2	Connect vom to A2J7 (+) and chassis ground (-). Slowly increase signal generator from 80 kHz until vom reads less than 0.5 V dc.	Signal generator frequency to be less than 120 kHz.	Check signal presence detector A2Q32, A2Q33, A2Q34, and A2Q39.
7.3	With signal generator set per step 7.2, connect dvm to P1-57 (+) and P1-59 (-).	Check for +17.5 to +18.5 V dc.	Check altitude discriminator adjustment.
7.4	With signal generator set to 80 kHz and 6 mV ac, slowly increase signal generator frequency until FCS WARN indicator just goes out. Record frequency. Slowly decrease signal generator frequency until FCS WARN just lights. Record frequency.	Check that the second recorded signal generator frequency is between 90 to 110 kHz. The difference between the two recorded frequencies to be at least 5 kHz.	
7.5	End time domain filter test. Disconnect scope. SIG GEN to OFF.		
8.0	TIME DOMAIN FILTER TEST		
	Use test setup in step 7.0 (no setup required if following step 7.5).		
8.1	SIG GEN to ON. Adjust signal generator frequency to 10 kHz. Adjust signal generator output for a standard output (refer to step 1.0). Connect scope to A1J1. Adjust scope so that one cycle occupies 10 cm.	Check that the negative portion of waveform is 5.7 to 6.3 cm wide. If incorrect, adjust A1R111 until negative portion of waveform is 6.0 cm.	Check zero crossing detector A2Q30, A2Q38, and A2Q31, 60/40 monostable multivibrator A1Q1 through A1Q6, and missing pulse detector A1Q27, A1Q28, A1Q29, A1Q30, A1Q43 circuits.
8.2	With equipment set from step 8.1, adjust the signal generator frequency to 400 Hz. Adjust scope so that one cycle occupies 10 cm.	Check that the negative portion of waveform is 5.4 to 6.6 cm.	Check the same components as in step 8.1.
8.3	With equipment set from step 8.2, adjust the signal generator frequency to 100 kHz. Adjust scope so that one cycle occupies 10 cm.	Check that the negative portion of waveform is 5.4 to 6.6 cm.	Check the same components as in step 8.1.
8.4	End time domain filter test. Disconnect scope. SIG GEN to OFF.		

Table 5-7. ALT-50A Detailed Performance Test (Cont).

STEP	PROCEDURE	DESIRED RESULTS	TROUBLESHOOTING SUGGESTIONS
9.0	MISSING PULSE DETECTOR TEST		
	Use test setup in step 7.0 (no setup required if following step 8.4).		
9.1	SIG GEN to ON. Connect scope to A1J1. Set scope to 20 micro s/cm and adjust the signal generator frequency to approximately 10 kHz so that there are exactly two full cycles in 10 cm. Adjust signal generator range switch to X100 (1 kHz). Observe scope and switch signal generator range switch to X1K (10 kHz).	Verify that there is only one cycle on the scope for approximately 1 second, then two cycles.	Check A1Q27, A1Q28, A1Q29, A1Q30, A1Q43 circuits.
9.2	End missing pulse detector test. Disconnect scope. SIG GEN to OFF.		
10.0	ALTITUDE DISCRIMINATOR TEST		
	Use test setup in step 7.0 (no setup required if following step 9.2). Perform altitude discriminator adjustment procedure as described in table 5-8 steps 7.0 through 7.8 before troubleshooting.		
10.1	SIG GEN to ON. Adjust signal generator frequency to 40,870 Hz. Adjust signal generator output to 2.4 V rms measured at SIG GEN OUT. Measure dc voltage at A1J6 (+) and chassis ground (-). Record voltage. Measure dc voltage at A1J7 (+) and chassis ground (-). Record voltage. Add the two recorded voltages.	Voltage sum must be +11.870 to +11.930 V dc.	Check altitude discriminator no 1 A1Q7, A1Q8, A1Q11, A1Q13 A1Q15, A1Q17, A1U1 for A1J6 voltage. Check altitude discriminator no 2 A1Q9, A1Q10, A1Q12, A1Q14, A1Q16, A1U2 for A1J7 voltage.
10.2	With signal generator set as per step 10.1, connect dvm to P1-57 (+) and P1-59 (-).	Voltage to be between +11.870 and +11.930 V dc.	Check sum amplifier A1U3, A1Q19 circuit.
10.3	Adjust signal generator frequency to 10,870 Hz. Connect dvm to P1-57 (+) and P1-59 (-).	Voltage to be between +5.350 and +5.450 V dc.	Check same circuits checked in steps 10.1 and 10.2.
10.4	Adjust signal generator frequency to 870 Hz. Connect dvm to P1-57 (+) and P1-59 (-).	Voltage to be between +0.380 and +0.420 V dc.	Check same circuits checked in steps 10.1 and 10.2.
10.5	Adjust signal generator frequency to 80,870 Hz. Connect dvm to A1J6 (+) and chassis ground (-).	Voltage to be between +8.780 and +8.900 V dc.	Check A1Q15, A1Q17, A1Q13 circuit.
10.6	With signal generator set as per step 10.5, connect dvm to P1-57 (+) and P1-59 (-).	Voltage to be between +14.84 and +14.96 V dc.	Check A1U1, A1U3, A1Q9 circuit.
10.7	SIG GEN to OFF. Connect dvm to P1-57 (+) and P1-59 (-).	Voltage to be between +17.5 and +18.5 V dc.	Check A1Q14, A1Q16, A1Q18 circuit.
10.8	SIG GEN to ON. Adjust signal generator frequency to 20,470 Hz. Connect dvm to P1-57 (+) and P1-59 (-).	Voltage to be between +10.150 and +10.250 V dc.	Check A1Q13, through A1Q18, A1U1, A1U2 circuit.
10.9	Adjust signal generator frequency to 21,270 Hz. Connect dvm to P1-57 (+) and P1-59 (-).	Voltage to be between +10.420 and +10.440 V dc.	Check same circuit as step 10.8

Table 5-7. ALT-50A Detailed Performance Test (Cont).

STEP	PROCEDURE	DESIRED RESULTS	TROUBLESHOOTING SUGGESTIONS
10.10	End altitude discriminator test. SIG GEN to OFF. Disconnect dvm.		
11.0	ALTITUDE TRIP TEST		
	Note The test procedure provides a test of the altitude trips set at the factory adjusted altitudes. The trips are factory adjusted to the following altitudes: TRIP NO. — ALTITUDE (ft) 1 — 200 2 — 500 3 — 1,000 4 — 1,500 The altitude trips can be field adjusted to other altitudes as described in the following procedure. If the altitude trips are changed to altitudes different from the factory adjusted altitudes, the dc voltage reading at P1-57 should be the dc analog altitude voltage ±5% for the altitude at which the trip is set. Refer to table 5-9 for a cross-reference between altitude, signal generator frequency, and dc analog altitude voltages. Prior to testing the altitude trip settings, check the ALT-50A front panel for a notice plate, CPN 634-0580-00X. Current production ALT-50A units have a notice plate installed which lists the factory adjusted altitude trip settings. When units without notice plate are serviced, it is highly recommended that a notice plate be installed, especially on units with nonstandard altitude trip settings. Refer to ALT-50A SIL 1-79 in the bulletins section of this publication for additional information. ***Troubleshooting Note*** Perform altitude trip adjustment procedure as described in table 5-8 steps 8.0 through 8.3 before troubleshooting.		
	(No setup is required if following step 10.10.) TEST SETUP Connect ALT-50A test equipment as shown in figure 5-5. Test fixture setup: TRIP ENABLE OFF MOD FREQ SELECT 100 Hz MOD PHASE SELECT 0 degrees PWR ON SIG GEN OFF AID SELECT 40		
11.1	TRIP ENABLE to ON. SIG GEN to ON. Adjust signal generator frequency to 870 Hz. Adjust signal generator output for 2.4 V rms measured at SIG GEN OUT. Adjust signal generator frequency to 80,870 HZ.	Check that ALT TRIP NO 1, NO 2, NO 3, and NO 4 indicators are not lit.	Check altitude trip circuits A1Q31 through A1Q42, and A1Q44 through A1Q47.
11.2	Slowly decrease signal generator until ALT TRIP 4 just lights.	Signal generator frequency to be between 57,870 Hz and 63,870 Hz.	Check altitude trip no 4 A1Q40, A1Q41, A1Q47, A1Q42 circuit.
11.3	Slowly decrease signal generator until ALT TRIP 3 just lights.	Signal generator frequency to be between 38,870 Hz and 42,870 Hz.	Check altitude trip no 3 A1Q37, A1Q38, A1Q46, A1Q39 circuit.

Table 5-7. ALT-50A Detailed Performance Test (Cont).

STEP	PROCEDURE	DESIRED RESULTS	TROUBLESHOOTING SUGGESTIONS
11.4	Slowly decrease signal generator until ALT TRIP 2 just lights.	Signal generator frequency to be between 19,870 Hz and 21,870 Hz.	Check altitude trip no 2 A1Q34, A1Q35, A1Q45, A1Q36 circuit.
11.5	Slowly decrease signal generator until ALT TRIP 1 just lights.	Signal generator frequency to be between 8,470 Hz and 9,270 Hz.	Check altitude trip no 1 A1Q31, A1Q32, A1Q44, A1Q33 circuit.
11.6	End altitude trip test. SIG GEN to OFF. TRIP ENABLE to OFF.		
12.0	BANDWIDTH CONTROL TEST		
	Use test setup in step 11.0 (no setup required if following step 11.6).		
12.1	SIG GEN to ON. Adjust signal generator frequency to 870 Hz. Adjust signal generator output for 2.4 V rms measured at SIG GEN OUT. Adjust signal generator frequency for 63 kHz. Connect dvm to A2J2 (+) and chassis ground (-). Connect scope probe to A2J3.	Check for a nominal +21 V dc on dvm and scope.	Check bandwidth control A2Q20 through A2Q29 and A2Q35 through A2Q39 circuits.
12.2	Slowly decrease signal generator frequency until dvm just switches to a nominal -4 V dc and scope remains at a nominal +21 V dc.	Frequency counter to indicate from 43.7 to 48.3 kHz.	Check A2Q24, A2Q37, A2Q25, A2Q27 circuit.
12.3	Slowly decrease signal generator frequency until dvm just switches to a nominal +21 V dc and scope switches to a nominal -4 V dc.	Frequency counter to indicate from 29,450 to 32,550 Hz.	Check A2Q22, A2Q23, A2Q36, A2Q28, A2Q29 circuit.
12.4	Slowly decrease signal generator frequency until dvm just switches to a nominal -4 V dc and scope remains at a nominal -4 V dc.	Frequency counter to indicate from 10,450 to 11,550 Hz.	Check A2Q20, A2Q21, A2Q35, A2Q27 circuit.
12.5	Disconnect dvm from A2J2 and scope probe from A2J3. Connect ac vtvm between A2J4 (H) and chassis (C). Adjust signal generator frequency to 115 kHz. Adjust signal generator output level for +15 dB indication (approx 4.4 V ac) on ac vtvm. Observe ac vtvm while connecting a jumper between A2J2 and chassis ground.	Check for a 4.5 to 7.5 dB reduction in ac vtvm indication when jumper to A2J2 is applied.	Check low-pass filter A2Q5 through A2Q13 and postamplifier A2Q14 through A2Q17 circuits.
12.6	Disconnect jumper from A2J2, and connect dvm to A2J2 (+) and chassis ground (-). Decrease signal generator frequency to 50 kHz, but stay above the point where dvm switches to a nominal -4 V dc. If dvm switches before 50 kHz is reached, increase frequency and then decrease to the point just above the switching point of the dvm. Adjust signal generator output for a +15 dB indication on ac vtvm. Observe ac vtvm while connecting a jumper between A2J3 and chassis ground.	Check for a 4.5 to 7.5 dB reduction in ac vtvm indication when jumper to A2J3 is applied.	Check low-pass filter A2Q5 through A2Q13 and postamplifier A2Q14 through A2Q17 circuits.

Table 5-7. ALT-50A Detailed Performance Test (Cont).

STEP	PROCEDURE	DESIRED RESULTS	TROUBLESHOOTING SUGGESTIONS
12.7	Disconnect jumper from A2J3 and chassis ground. Decrease signal generator frequency to 22 kHz. Adjust signal generator output level for a +15 dB indication on ac vtvm. Disconnect dvm from A2J2. Observe ac vtvm while connecting a jumper between A2J2 and chassis ground.	Check for a 4.5 to 7.5 dB reduction in ac vtvm indication when jumper to A2J2 is applied.	Check low-pass filter A2Q5 through A2Q13 and postamplifier A2Q14 through A2Q17 circuits.
12.8	End bandwidth control test. Remove jumper from A2J2 and chassis ground. Disconnect ac vtvm. SIG GEN to OFF.		
13.0	AID AND 0-FOOT ALTITUDE TEST		
	Use test setup in step 11.0 (no setup required if following step 12.8).		
13.1	SIG GEN to ON. Adjust signal generator frequency to 470 Hz. Adjust signal generator output level for 2.4 V rms measured at SIG GEN OUT. AID SELECT to 20. Connect dvm to P1-57 (+) and P1-59 (-).	Voltage to be between +0.360 and +0.440 V dc.	Check AID disable A1Q20, A1Q21, A1Q22, A1Q48 circuit.
13.2	AID SELECT to 40. Adjust signal generator frequency to 870 Hz. Connect dvm to P1-57 (+) and P1-59 (-).	Voltage to be between +0.360 and +0.440 V dc.	Check AID disable A1Q20, A1Q21, A1Q22, A1Q48 circuit.
13.3	AID SELECT to 57. Adjust signal generator frequency to 1210 Hz. Connect dvm to P1-57 (+) and P1-59 (-).	Voltage to be between +0.360 and +0.440 V dc.	Check AID disable A1Q20, A1Q21, A1Q22, A1Q48 circuit.
13.4	End aid and 0-foot altitude test. AID SELECT to 40. SIG GEN to OFF. PWR to OFF.		
14.0	250-FOOT ALTITUDE ACCURACY TEST		
	TEST SETUP Connect ALT-50A to rf loop as shown in figure 5-8. Test fixture setup: TRIP ENABLE OFF MOD FREQ SELECT 100 Hz MOD PHASE SELECT 0 degrees PWR ON SIG GEN OFF AID SELECT 40 **_Troubleshooting Note_** Perform the mixer alignment procedure as described in table 5-8 steps 5.0 through 5.2 and altimeter calibration procedure as described in table 5-8 steps 9.0 through 9.4 before troubleshooting. If alignment and calibration do not correct the malfunction, check mixer A7 circuits.		
14.1	Adjust variable attenuator for a total rf loop decibel loss of 96 dB (refer to figure 5-8 for calculation). Calculate time delay of rf loop (refer to figure 5-8). Connect dvm to P1-57 (+) and P1-59 (-). Using table 5-6 and calculated time delay, find voltage corresponding to time delay.	Compare dc voltage of dvm indication with voltage from table 5.6.	

Table 5-7. ALT-50A Detailed Performance Test (Cont).

STEP	PROCEDURE	DESIRED RESULTS	TROUBLESHOOTING SUGGESTIONS
14.2	MOD FREQ SELECT to 105 Hz. MOD PHASE SELECT to 180 degrees. dvm Connect dvm to P1-57 (+) and P1-59 (-).	Compare dc voltage of dvm indication with the voltage from table 5.6 (use same voltage from table as in step 14.1).	
14.3	End 250-foot altitude test. PWR to OFF.		
15.0	FCS WARN TEST		
	TEST SETUP Connect ALT-50A to test equipment as shown in figure 5-5. Test fixture setup: TRIP ENABLE OFF MOD FREQ SELECT 100 Hz MOD PHASE SELECT 0 degrees PWR ON SIG GEN OFF AID SELECT 40		
15.1	SIG GEN to ON. Adjust signal generator frequency to 20,870. Adjust signal generator output level for 2.4 V rms measured at A2J1.	Check that FCS WARN is lit.	Check FCS warn A1Q23 through A1Q26 circuit.
15.2	Increase signal generator frequency to 130 kHz and output level to maximum.	Check that FCS WARN is not lit.	Check FCS warn A1Q23 through A1Q26 circuit.
15.3	Decrease signal generator frequency to 20,870 Hz. Connect dvm to P1-8 (+) and P1-3 (-).	Dvm voltage to be between +26 and +30 V dc.	Check FCS warn A1Q23 through A1Q26 circuit.
15.4	Connect a 100-ohm, 10-watt resistor and dvm to P1-8 (+) and P1-3 (-).	Dvm voltage to be between +10 and +20 V dc.	Check FCS warn A1 Q23 through A1Q26 circuit.
15.5	End FCS WARN test. Disconnect 100-ohm resistor and dvm. SIG GEN to OFF.		
16.0	SELF-TEST TEST		
	Use test setup in step 15.0 (no setup required if following step 15.4).		
16.1	Connect dvm to P1-57 (+) and P1-59 (-). Observe dvm, while depressing SELF-TEST switch.	Voltage to be between +1.360 and +1.440 V dc. FCS WARN indicator is not lit.	Check self-test gate A2Q18, A2Q19, A1Q20, A1Q48, and FCS warn A1Q23 through Q26 circuit.
16.2	Connect dvm to P1-57 (+) and P1-59 (-). AID SELECT to 20. Observe dvm, while depressing SELF-TEST switch.	Voltage to be between +1.360 and +1.440 V dc.	Check self-test gate A2Q18, A2Q19, A1Q20, A1Q48, circuit.
16.3	Connect dvm to P1-57 (+) and P1-59 (-). AID SELECT to 57. Observe dvm, while depressing SELF-TEST switch.	Voltage to be between +1.360 and +1.440 V dc.	Check self-test gate A2Q18, A2Q19, A1Q20, A1Q48, circuit.

Table 5-7. ALT-50A Detailed Performance Test (Cont).

STEP	PROCEDURE	DESIRED RESULTS	TROUBLESHOOTING SUGGESTIONS
16.4	Connect dvm to P1-57 (+) and P1-59 (-). AID SELECT to 40. MOD FREQ SELECT to 105 Hz. MOD PHASE SELECT to 180 degrees. Observe dvm, while depressing SELF-TEST switch.	Voltage to be between +1.360 and +1.440 V dc. FCS WARN indicator is not lit.	Check modulation test as described in step 3.0.
16.5	End self-test test. PWR to OFF. SIG GEN to OFF. Disconnect dvm. MOD FREQ to 100 Hz. MOD PHASE SELECT to 0 degrees.		
17.0	VSWR TEST		
	TEST SETUP Connect ALT-50A to test equipment as shown in figure 5-11. Test fixture setup: TRIP ENABLE OFF MOD FREQ SELECT 100 Hz MOD PHASE SELECT 0 degrees PWR ON SIG GEN OFF AID SELECT 40		
17.1	Set the variable attenuator to maximum attenuation. Connect ac vtvm to A2J4. Slowly decrease the variable attenuator until FCS WARN indicator lights and record the dB reading on the vtvm. Label this recording as record A. **Caution** The ALT-50A has no load in the following tests. Do not leave the ALT-50A connected this way any longer than is necessary to complete this test. Disconnect the 20-dB attenuator from the transmitter test cable. Jumper A2J2 and A2J3 to ground. Record the dB reading on the vtvm. Label this recording as record B. Reconnect the 20-dB attenuator to the transmitter test cable. Disconnect the 20-dB attenuator from the receiver test cable. Record the db reading on the vtvm. After recorded PWR to OFF. Label this recording as record C.	Compute the difference between record A and record B. The difference is to be at least 10 dB. Compute the difference between record A and record C. The difference is to be at least 10 dB.	Check mixer A7HY1 and A7HY2.
18.0	End detailed performance test. Disconnect ALT-50A from test setup and install dust cover.		

Table 5-8. ALT-50A Alignment/Adjustment Procedure.

STEP	PROCEDURE	DESIRED RESULTS	ADJUSTMENT
1.0	TEST SETUP Remove ALT-50A dust cover. Connect ALT-50A and test equipment as shown in figure 5-5. Turn signal generator on and allow it to stabilize. Adjust 0- to +35-V dc power supply to +28.00 V dc. Test fixture setup: TRIP ENABLE OFF MOD FREQ SELECT 100 Hz MOD PHASE SELECT 0 degrees PWR ON SIG GEN OFF AID SELECT 40 Allow a 15-minute warmup of ALT-50A. Unless otherwise specified, the standard signal from the signal generator is 2.4 V rms measured at SIG GEN OUT.		
2.0	POWER SUPPLY A6 ADJUSTMENT		
2.1	Connect frequency counter to A6A1U201-3.	Frequency to be 10.0 ±0.3 kHz.	If out of tolerance perform the following: 1. Turn off power supplies. 2. Unsolder and remove A6A1R212. 3. Connect decade box in place of A6A1R212 removed in step 2. 4. Turn on power supplies. 5. Adjust decade box between 45.3 and 51.1 kΩ to obtain 10.0 ±0.3 kHz. 6. Turn off power supplies. 7. Disconnect decade box and select A6A1R212, as near as possible, from the following values: 45.3, 46.4, 47.5, 48.7, 49.9, and 51.1 kΩ. 8. Solder new R212 on A6A1. 9. Turn on power supplies, and verify frequency is within limits.
2.2	Connect dvm to P1-49 (+) and P1-3 (-)	+22.000 ±0.010 V dc.	Adjust A6R111 for +22.000 V dc.
2.3	Connect dvm to P1-51 (+) and P1-3 (-)	-15.000 ± 0.010 V dc.	Adjust A6R116 for -15.000 V dc.
2.4	End power supply adjustment. Disconnect dvm. PWR to OFF. Perform detailed performance test as per table 5-7.		
3.0	TRANSMITTER ALIGNMENT		
	TEST SETUP Remove dust cover of transmitter by removing nine screws to cover. Install transmitter alignment dust cover fixture (figure 5-3) on transmitter A5. Connect ALT-50A and test equipment as shown in figure 5-7 for alignment setup. Adjust scope for dc input. Set vertical control for 0.02 V/cm. Set horizontal control for 1.0 ms/cm. Connect scope external trigger to A3J2. For alignment A5 adjustment locations, refer to figure 5-9. Test fixture setup: TRIP ENABLE OFF MOD FREQ SELECT 100 Hz MOD PHASE SELECT 0 degrees PWR ON SIG GEN OFF AID SELECT 40 Allow 15-minute warmup period before proceeding.		

Table 5-8. ALT-50A Alignment/Adjustment Procedure (Cont).

STEP	PROCEDURE	DESIRED RESULTS	ADJUSTMENT
3.1	Adjust frequency meter to 4300 MHz. Jumper A4J4 to chassis ground.	Power meter reading plus cable loss to equal a minimum of 210 mW.	Adjust A5C4 (using adjustment tool specified in table 5-1) to maximize power output.
3.2	Observe scope. There should be two marker spikes at approximately the 1/4 and 3/4 points across the display. One complete modulation cycle is being displayed, and each marker represents the center frequency of its respective half cycle. Adjust frequency meter until two marker represents the center frequency of its respective half cycle. Adjust frequency meter until two marker spikes at right edge of scope just merge. Record frequency meter indication (one end-point frequency of the sweep). Adjust frequency meter in opposite direction, past 4300 MHz until two marker spikes at center of scope just merge. Record frequency meter indication (the other end-point frequency of the sweep). Add the two recorded end-point frequencies and divide the results by 2. The resulting frequency is the actual center frequency.	The center frequency to be between 4295 and 4305 MHz.	If the obtained center frequency is not within tolerance, adjust frequency meter to 4300, then adjust A3R61 clockwise to increase frequency or counterclockwise to decrease frequency. Repeat finding end-points procedure to obtain new center frequency (adjusting A3R61 simultaneously increases or decreases both end-point frequencies recorded). If necessary repeat adjustment of A3R61 if center frequency is not within tolerance.
3.3	Adjust frequency meter to 4251 MHz.	Frequency end-points to approximately 4251 and 4349 MHz.	Adjust A4R24 until two marker spikes at center of scope just merge. Adjust frequency meter to 4349 MHz. Adjust A3R61 until two marker spikes at right edge of scope just merge. (Adjusting A4R24 simultaneously moves both end-point frequencies closer together or spreads them farther apart. The center frequency is not greatly affected by adjusting A4R24.)
3.4	Adjust frequency meter to 4300 MHz.	Flatness of output power at maximum power output.	Adjust A5C4 to maximize power output. Alternately adjust A5C10 and A5R1 to maximize flatness and power output.
3.5	Connect second vertical input of scope to A4J1. Set sweep rate for 0.5 ms/cm.	Amplitude must not be less than 8-V peak-to-peak.	Adjust A5Z1 and A5Z2 to maximize uniformity and magnitude of individual cycles of the A4J1 waveform.

Table 5-8. ALT-50A Alignment/Adjustment Procedure (Cont).

STEP	PROCEDURE	DESIRED RESULTS	ADJUSTMENT
3.6			Readjust A5C4 slightly, as necessary, to best equalize duration of individual cycles of the A4J1 waveform consistent with adequate power output. (The scope 5X magnifier may be used for this determination, neglect the distorted cycles near the turnaround.)
3.7		Center frequency to be 4295 and 4305 MHz.	Redetermine center frequency by repeating procedure of step 3.2. If necessary, readjust A3R61 so that the center frequency falls between 4295 and 4305 MHz.
3.8	Check that power meter indicates not less than 150 milliwatts. Test cable loss must be considered to determine correct power output.		If power is less than 150 milliwatts, repeat steps 3.4 through 3.8.
3.9	Adjust frequency meter for decreasing frequency until two spikes at the center of scope just merge. Observe frequency meter indication. Subtract frequency meter indication from 4349 MHz. Divide result by 2, and subtract the answer from 4349 MHz. The resulting frequency is the center frequency.	The center frequency is to be between 4299 and 4301 MHz.	If the center frequency is not within tolerance, adjust frequency meter to 4300 MHz, then trim A3R61 clockwise to increase frequency or counterclockwise to decrease frequency, and repeat this step until specified center frequency is obtained.
3.10	Check that transmitter output waveform is flat across the passband.	Checking transmitter bandpass.	If output is not flat, repeat steps 3.1 through 3.10.
3.11	Check that transmitter output power is not less than 210 milliwatts. Test cable loss must be considered to determine correct power meter indication.	Transmitter power plus cable loss to equal not less than 210 milliwatts.	If power is less than 210 milliwatts, repeat steps 3.1 through 3.11.
3.12	PWR to OFF. Remove transmitter alignment dust cover from A5. PWR to ON. Connect dvm to A5 OSC test point (+) and chassis ground (-).	+19.0 to +19.6 V dc.	If voltage is incorect, troubleshoot transmitter current regulator circuits on modulator A3 and 1433-MHz oscillator A5Q1 circuit.
3.13	Connect dvm to A5 PA test point (+) and chassis ground (-).	+19.0 to +19.6 V dc.	If voltage is incorrect, troubleshoot transmitter current regulator circuits on modulator A3 and power amplifier A5Q2 circuit.
3.14	Connect dvm to A5C6 (+) and chassis ground (-).	-0.550 to +0.550 V dc.	If voltage is incorrect, troubleshoot transmitter current regulator circuits on modulator A3.

Table 5-8. ALT-50A Alignment/Adjustment Procedure (Cont).

STEP	PROCEDURE	DESIRED RESULTS	ADJUSTMENT
3.15	Connect dvm to A5C8 (+) and chassis ground (–).	Voltage to be less than +0.700 V dc.	If voltage is incorrect, troubleshoot transmitter current regulator circuits on modulator A3, and A5Q1, A5Q2.
3.16	Connect dvm to A5C5 (+) and chassis ground (–).	+5.0 to +12.0 V dc.	If voltage is incorrect, troubleshoot A5Q1 and associated circuitry.
3.17	End transmitter alignment. PWR to OFF. Install original transmitter dust cover. Remove jumper between A4J4 and chassis. Perform altimeter calibration procedure as described in steps 9.0 through 9.5.		
4.0	MODULATOR A3 OSCILLATOR ADJUSTMENT		
	TEST SETUP Remove transmitter A5, modulator A3, and control A4 assembly as described in disassembly paragraph 5.6.5.8. Connect assembly to transmitter/modulator test fixture as shown in figure 5-10. Ensure that transmitter output is loaded by connecting a 20-dB pad to A5J1. Refer to paragraph 5.2.2 for test fixture fabrication information. Test fixture setup: MOD CONT V DC OFF MOD FREQ SELECT 100 Hz MOD PHASE SELECT 0 degree Adjust 0 to +30 V dc power supply to +22.000 V dc. Adjust 0 to –15 V dc power supply to –15.000 V dc. Connect frequency counter to MOD OSC PHASE LOCK NO 2 jack on test fixture. Turn off power supplies.		
4.1	Check frequency counter indication.	Counter to indicate 99 to 101 Hz.	If counter indication is incorrect, turn power supplies off. Unsolder and remove resistor A3R41. Connect a decade box in place of resistor A3R42. Turn on power supplies. Adjust decade box as close as possible to a counter indication of 100 Hz (between 505 and 569 ohms). Select the resistor closest to the decade box resistance from test select resistor kit CPN 618-2439-001. See parts list in the diagrams section for resistor kit values. Solder in new resistor and check that the frequency counter indicates 99 to 101 Hz. If not, repeat this step (4.1).

Table 5-8. ALT-50A Alignment/Adjustment Procedure (Cont).

STEP	PROCEDURE	DESIRED RESULTS	ADJUSTMENT
4.2	Set MOD FREQ switch to 105 Hz. Check frequency counter.	Frequency counter to indicate from 104 to 106 Hz.	If counter indication is incorrect, check A3R38 or select a value A3R41 that will satisfy both steps 4.1 and 4.2
4.3	End modulator A3 oscillator adjustment. Disconnect transmitter/modulator/modulator control assembly from test fixture. Install transmitter/modulator control assembly in ALT-50A as described in assembly paragraph 5.4.2.4. Perform complete detailed performance test as described in table 5-7.		
5.0	MIXER ALIGNMENT		
	TEST SETUP Connect ALT-50A and test equipment in rf loop as shown in figure 5-8. Connect ac vtvm to LO PASS FLTR OUT jacks on test fixture. Connect scope to HI PASS FLTR OUT jacks on test fixture. Connect A2J4 to FILTER IN (H) jack and chassis ground to FILTER IN (C) jack. Test fixture setup: TRIP ENABLE OFF MOD FREQ SELECT 100 Hz MOD PHASE SELECT 0 degrees PWR ON SIG GEN OFF AID SELECT 40		
5.1	Adjust variable attenuator for a clean but unsaturated signal on the scope.		Adjust A7Z1 through A7Z6 for a minimum (low frequency) on ac vtvm and at same time on the scope. a maximum (high frequency) on the scope. The adjustments are highly interactive and should be repeated several times to ensure good results. Do not leave any screw less than 1/4 turn from shorting out at the bottom.
5.2	End mixer alignment. PWR to OFF. Disconnect 20-dB attenuator on transmit test cable from variable attenuator and 20-dB attenuator on receive test cable from delay line. Disconnect A2J4 input from test fixture. Perform complete detailed performance test as described in table 5-7.		
6.0	RECEIVER LOW-FREQUENCY RESPONSE ADJUSTMENT		
	TEST SETUP Remove altitude processor A1 as described in disassembly paragraph 5.4.1.2. (Separation of A1 from A2 is not necessary.) Connect ALT-50A and test equipment as shown in figure 5-8. Adjust variable attenuator for total rf loop loss of 96 dB. Test fixture setup: TRIP ENABLE OFF MOD FREQ SELECT 100 Hz MOD PHASE SELECT 0 degrees PWR ON SIG GEN ON AID SELECT 40 Connect ac vtvm between A2J4 (H) and chassis ground (C).		

Table 5-8. ALT-50A Alignment/Adjustment Procedure (Cont).

STEP	PROCEDURE	DESIRED RESULTS	ADJUSTMENT
6.1	Adjust signal generator frequency to 10 kHz and adjust signal generator output leavel for an ac vtvm indication of +10 dB (2.4 ac nominal). Decrease signal generator frequency to 40 Hz.	Ac vtvm to indicate +10 ±6 dB	If ac vtvm indication is above +16 dB, decrease capacitance value of A2C3 at a rate of one value for each decibel above. If ac vtvm indication is below +4 dB, increase capacitance value A2C3 at a rate of one value for each decibel below. Select capacitor A2C3 values are as follows: 470, 510, 560, 620, 680, 750, 820, 910, 1000, 1100, and 1200 pF. See diagrams section for capacitor CPN's. Verify that the frequency from 400 Hz to 82 kHz falls within +4 dB and +16 dB. If not, reselect A2C3 as required to fall within specification.
6.2	End receiver low-frequency response adjustment. SIG GEN to OFF. PWR to OFF. Install altitude processor A1 as described in assembly paragraph 5.4.2.5. Perform detailed performance test as described in table 5-7.		
7.0	ALTITUDE DISCRIMINATOR ADJUSTMENT		
	TEST SETUP Connect ALT-50A to test equipment as shown in figure 5-5. Test fixture setup: TRIP ENABLE OFF MOD FREQ SELECT 100 Hz MOD PHASE SELECT 0 degrees PWR ON SIG GEN ON AID SELECT 40		
7.1	Connect ac vtvm to A2J4 (H) and chassis ground (-). Adjust signal generator frequency to 870 Hz. Adjust signal generator output level for an ac vtvm indication of +10 dB (2.4 V ac nominal). Connect dvm to A1J6 (+) and chassis ground (-).	Dvm to indicate between +0.338 to +0.342 V dc.	If dvm voltage is out of tolerance adjust A1R45.
7.2	Connect dvm to A1J7 and chassis ground (-)	Dvm to indicate between +0.058 and +0.062 V dc.	If dvm voltage is out of tolerance adjust A1R58.
7.3	Adjust signal generator frequency to 16.87 kHz. With signal generator output level set as per step 7.1, connect dvm to A1J6 and chassis ground (-).	Dvm to indicate between +7.13 to +7.15 V dc	If dvm voltage is out of tolerance adjust A1R21.
7.4	Adjust signal generator frequency to 80.87 kHz. With signal generator output level set as per step 7.1, connect dvm to A1J7 and chassis ground (-).	Dvm to indicate between +6.05 to +6.0 V dc	If dvm voltage is out of tolerance adjust A1R35.
7.5	Connect dvm to A1J8 (+) and chassis ground (-).	Dvm to indicate between +14.89 and +14.91 V dc	If dvm voltage is out of tolerance adjsut A1R71.

Table 5-8. ALT-50A Alignment/Adjustment Procedure (Cont).

<table>
<tr><th>STEP</th><th>PROCEDURE</th><th>DESIRED RESULTS</th><th>ADJUSTMENT</th></tr>
<tr><td>7.6</td><td>Adjust signal generator to 870 Hz. Set output level for ac vtvm indication of +10 dB (2.4 V ac is nominal). Connect dvm to A1J8 (+) and chassis ground (-).</td><td>Dvm to indicate between +0.398 and +0.402 V dc</td><td>If dvm voltage is out of tolerance adjust A1R71.</td></tr>
<tr><td>7.7</td><td colspan="2">Connect dvm to A1J8 (+) and chassis ground (-). Check for the voltages listed at the following frequencies. If any voltages are out of tolerance repeat steps 7.1 through 7.6.
<table>
<tr><th>FREQUENCY (Hz)</th><th>A1J8 VOLTAGE (V dc)</th></tr>
<tr><td>870</td><td>+0.398 to +0.402 (+0.400 nom)</td></tr>
<tr><td>4870</td><td>+2.395 to +2.405 (+2.400 nom)</td></tr>
<tr><td>16870</td><td>+8.390 to +8.410 (+8.400 nom)</td></tr>
<tr><td>20470</td><td>+10.185 to +10.215 (+10.200 nom)</td></tr>
<tr><td>21270</td><td>+10.427 to +10.433 (+10.430 nom)</td></tr>
<tr><td>24870</td><td>+10.697 to +10.703 (+10.700 nom)</td></tr>
<tr><td>40870</td><td>+11.896 to +11.904 (+11.900 nom)</td></tr>
<tr><td>80870</td><td>+14.892 to +14.908 (+14.900 nom)</td></tr>
</table>
</td><td></td></tr>
<tr><td>7.8</td><td colspan="3">End altitude discriminator adjustment. PWR to OFF. SIG GEN to OFF. Perform final performance as described in table 5-4.</td></tr>
<tr><td>8.0</td><td colspan="3">ALTITUDE TRIP ADJUSTMENT</td></tr>
<tr><td></td><td colspan="3">GENERAL
The altimeter contains four shop adjustable altitude trips. The trips provide a ground output to the flight control system and/or other aircraft systems when the aircraft descends to trip point altitude. The altitude trips are factory adjusted to the following altitudes:
<table>
<tr><th>TRIP NO.</th><th>ALTITUDE (ft)</th></tr>
<tr><td>1</td><td>200</td></tr>
<tr><td>2</td><td>500</td></tr>
<tr><td>3</td><td>1,000</td></tr>
<tr><td>4</td><td>1,500</td></tr>
</table>
The adjustment procedures described in step 8.2 provide instructions for adjustment of the altitude trips to the factory settings. If altitude trips are required at other than the factory adjusted altitudes, refer to step 8.1 for determining the correct input frequency for the selected altitude. The new trip point altitudes should be recorded for use during further testing, troubleshooting, and adjustment of the altimeter.</td></tr>
<tr><td>8.1</td><td colspan="3">ALTITUDE CONVERSION CHART
An altitude conversion chart is presented in table 5-9. The chart converts altitude to the required input frequency at the preamplifier for each of the three different aircraft installation delays (AID). The chart converts the altitude and/or input frequency to the dc analog altitude output voltage.
The input frequencies were calculated using the following equation:
F = 40(H + AID/2) + 70 Hz.
Where:
F = if input frequency in Hz
H = altitude in feet
40 = 40 Hz per foot of altitude
AID = aircraft installation delay</td></tr>
</table>

Table 5-8. ALT-50A Alignment/Adjustment Procedure (Cont).

STEP	PROCEDURE	DESIRED RESULTS	ADJUSTMENT
8.1 (Cont)	The dc analog altitude output voltages were calculated using the following equations: For 0 to 500 foot altitudes: $V = 0.02 \times (H + 20)$ Where: V = dc analog altitude output voltage 0.02 = dc voltage per foot of altitude H = altitude in feet 20 = altitude in feet to obtain a 0-foot altitude (0.0 V dc = -20 feet) For 500 to 2000 foot altitudes: $V = 10.4 + [(H - 500) \times 0.003]$ Where: V = dc analog altitude output voltage 10.4 = dc analog altitude output voltage for 500 feet H = altitude in feet 500 = altitude for +10.4 V dc analog altitude voltage 0.003 = dc analog voltage per foot for altitudes above 500 feet.		
8.2	ADJUSTMENT PROCEDURE ***Note*** Prior to adjusting the altitude trip settings, check the ALT-50A front panel for a notice plate, CPN 634-0580-00X. Current production ALT-50A units have a notice plate installed which lists the factory adjusted altitude trip settings. When units without notice plates are serviced, it is highly recommended that a notice plate be installed, especially on units with nonstandard altitude trip settings. If the altitude trip settings are changed, a new notice plate should be installed. Refer to ALT-50A SIL 1-79 in the bulletins section of this instruction book for additional information. TEST SETUP Connect ALT-50A to test equipment as shown in figure 5-5. Test fixture setup: TRIP ENABLE ON MOD FREQ SELECT 100 Hz MOD PHASE SELECT 0 degrees PWR ON SIG GEN ON AID SELECT 40 Connect ac vtvm between A2J4 (H) and chassis ground (C).		
8.2.1	Adjust signal generator frequency to 80 kHz, and adjust output level for an ac vtvm indication of +10 dB (2.4 V ac is nominal). Decrease signal generator frequency to 60.870 Hz.	ALT TRIP NO 4 indicator just lights.	Adjust A1R157 until ALT TRIP NO 4 just lights.
8.2.2	Adjust signal generator frequency to 40.870 Hz.	ALT TRIP NO 3 indicator just lights.	Adjust A1R149 until ALT TRIP NO 3 just lights.
8.2.3	Adjust signal generator frequency to 20.870 Hz.	ALT TRIP NO 2 indicator just lights.	Adjust A1R138 until ALT TRIP NO 2 just lights.
8.2.4	Adjust signal generator frequency to 8.870 Hz.	ALT TRIP NO 1 indicator just lights.	Adjust A1R137 until ALT TRIP NO 1 just lights.

Table 5-8. ALT-50A Alignment/Adjustment Procedure (Cont).

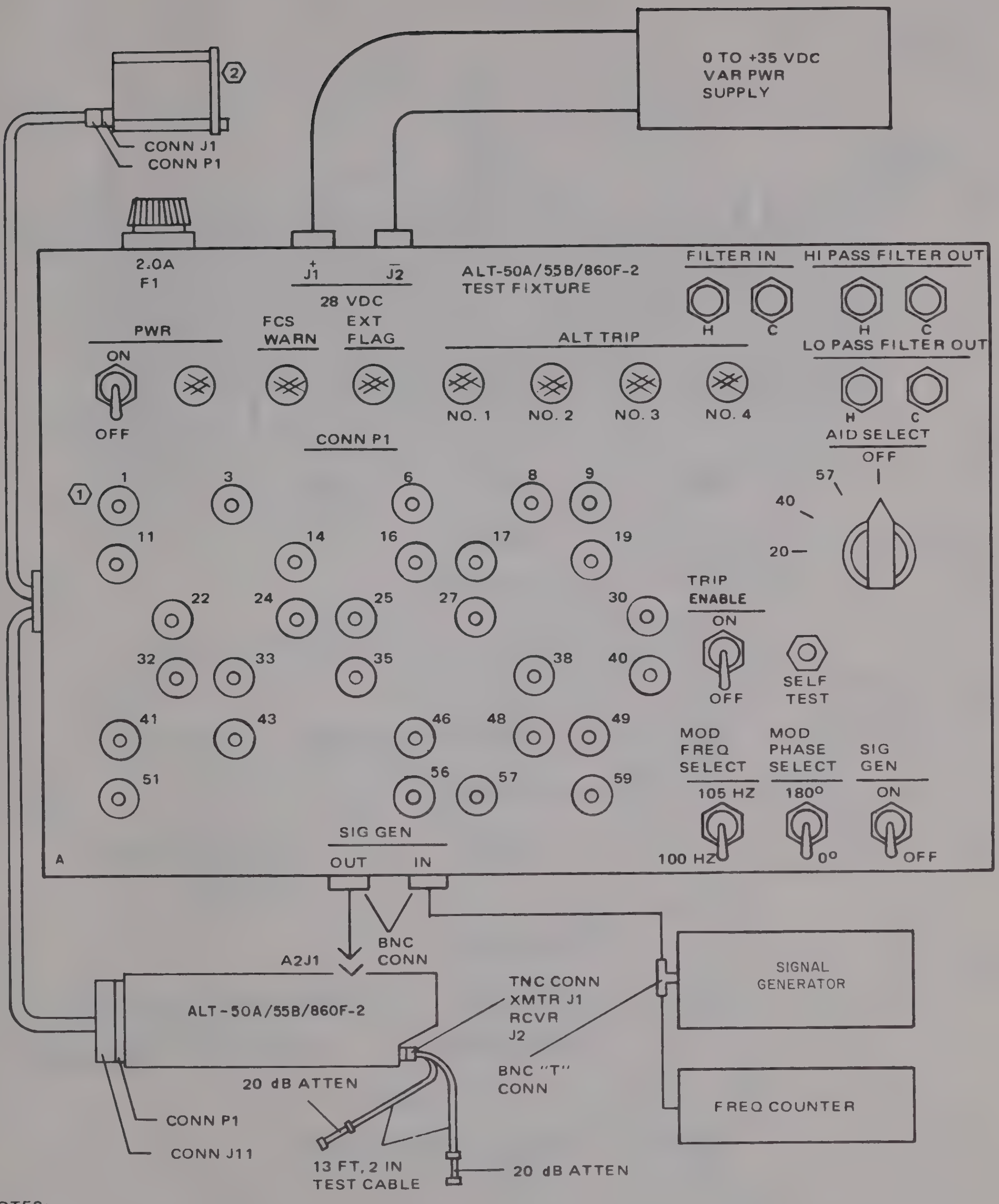
STEP	PROCEDURE	DESIRED RESULTS	ADJUSTMENT
8.3	End altitude trip adjustment. PWR to OFF. SIG GEN to OFF. TRIP ENABLE to OFF. Perform detailed performance test as described in table 5-8.		
9.0	ALTIMETER CALIBRATION		
	TEST SETUP Connect ALT-50A to rf loop as shown in figure 5-8. Test fixture setup: TRIP ENABLE OFF MOD FREQ SELECT 100 Hz MOD PHASE SELECT 0 degrees PWR ON SIG GEN OFF AID SELECT 40		
9.1	Calculate total rf loop time delay as shown in figure 5-8, and record. Adjust variable attenuator to minimum attenuation. Connect scope probe to A2J4. Check that the waveform at A2J4 is clipped. Use the following formula to calculate the frequency at A1J1: A1J1 FREQ = 19.67 × T + 70. Where: T = the calculated time delay recorded above. Connect a frequency counter to A1J1.		Adjust A4R24 until the frequency counter indicates the frequency calculated for A1J1 ±200 Hz.
9.2	Calculate altitude analog voltage (in mV dc) as follows and record: ALT ANALOG VDC = 9.836 × T Where: T = the calculated time delay recorded in step 9.1. Connect a dvm to P1-57 (+) and P1-59 (-).		Check that the calculated ALT ANALOG VDC is with ±50 mV dc of the dvm indication from P1-57 (+) and P1-59 (-).
9.3	Adjust variable attenuator to make the total rf loop decibel loss equal to 95 dB. Calculate altitude analog voltage (in mV dc) as follows and record: ALT ANALOG VDC = 9.836 × T Where: T = the calculated time delay recorded in step 9.1. Connect a dvm to P1-57 (+) and P1-59 (-).		Check that the calculated ALT ANALOG VDC is within ±50 mV dc of the dvm indication from P1-57 (+) and P1-59 (-).
9.4	End altimeter calibration. PWR to OFF. Disconnect dvm and scope. Perform the detailed performance test as described in table 5-7.		

Table 5-9. Altitude Conversion Chart.

ALTITUDE (ft)	IF INPUT FREQUENCY (Hz)			NOMINAL DC ANALOG ALTITUDE OUTPUT VOLTAGE (V)
	20-FT AID	40-FT AID	57-FT AID	
0	470	870	1210	0.400
10	870	1270	1610	0.600
20	1270	1670	2010	0.800
30	1670	2070	2410	1.000
40	2070	2470	2810	1.200
50	2470	2870	3210	1.400
60	2870	3270	3610	1.600
70	3270	3670	4010	1.800
80	3670	4070	4410	2.000
90	4070	4470	4810	2.200
100	4470	4870	5210	2.400
110	4870	5270	5610	2.600
120	5270	5670	6010	2.800
130	5670	6070	6410	3.000
140	6070	6470	6810	3.200
150	6470	6870	7210	3.400
160	6870	7270	7610	3.600
170	7270	7670	8010	3.800
180	7670	8070	8410	4.000
190	8070	8470	8810	4.200
200	8470	8870	9210	4.400
210	8870	9270	9610	4.600
220	9270	9670	10010	4.800
230	9670	10070	10410	5.000
240	10070	10470	10810	5.200
250	10470	10870	11210	5.400
260	10870	11270	11610	5.600
270	11270	11670	12010	5.800
280	11670	12070	12410	6.000
290	12070	12470	12810	6.200
300	12470	12870	13210	6.400
310	12870	13270	13610	6.600
320	13270	13670	14010	6.800
330	13670	14070	14410	7.000
340	14070	14470	14810	7.200
350	14470	14870	15210	7.400
360	14870	15270	15610	7.600
370	15270	15670	16010	7.800
380	15670	16070	16410	8.000
390	16070	16470	16810	8.200
400	16470	16870	17210	8.400
410	16870	17270	17610	8.600
420	17270	17670	18010	8.800
430	17670	18070	18410	9.000
440	18070	18470	18810	9.200
450	18470	18870	19210	9.400
460	18870	19270	19610	9.600
470	19270	19670	20010	9.800
480	19670	20070	20410	10.000
490	20070	20470	20810	10.200
500	20470	20870	21210	10.400
600	24470	24870	25210	10.700
700	28470	28870	29210	11.000
800	32470	32870	33210	11.300
900	36470	36870	37210	11.600
1000	40470	40870	41210	11.900
1100	44470	44870	45210	12.200

Table 5-9. Altitude Conversion Chart (Cont).

ALTITUDE (ft)	IF INPUT FREQUENCY (Hz)			NOMINAL DC ANALOG ALTITUDE OUTPUT VOLTAGE (V)
	20-FT AID	40-FT AID	57-FT AID	
1200	48470	48870	49210	12.500
1300	52470	52870	53210	12.800
1400	56470	56870	57210	13.100
1500	60470	60870	61210	13.400
1600	64470	64870	65210	13.700
1700	68470	68870	69210	14.000
1800	72470	72870	73210	14.300
1900	76470	76870	77210	14.600
2000	80470	80870	81210	14.900


0 TO +35 VDC
VAR PWR
SUPPLY
②
CONN J1
CONN P1
2.0A
F1
+
J1
—
J2
28 VDC
ALT-50A/55B/860F-2
TEST FIXTURE
FILTER IN
H
C
HI PASS FILTER OUT
H
C
LO PASS FILTER OUT
H
C
PWR
ON
OFF
FCS
WARN
EXT
FLAG
ALT TRIP
NO. 1
NO. 2
NO. 3
NO. 4
CONN P1
AID SELECT
OFF
57
40
20
①
1
3
6
8
9
11
14
16
17
19
22
24
25
27
30
32
33
35
38
40
41
43
46
48
49
51
56
57
59
TRIP
ENABLE
ON
OFF
SELF
TEST
MOD
FREQ
SELECT
105 HZ
100 HZ
MOD
PHASE
SELECT
180°
0°
SIG
GEN
ON
OFF
A
SIG GEN
OUT
IN
BNC
CONN
A2J1
ALT-50A/55B/860F-2
TNC CONN
XMTR J1
RCVR
J2
BNC "T"
CONN
SIGNAL
GENERATOR
FREQ COUNTER
20 dB ATTEN
CONN P1
CONN J11
13 FT, 2 IN
TEST CABLE
20 dB ATTEN

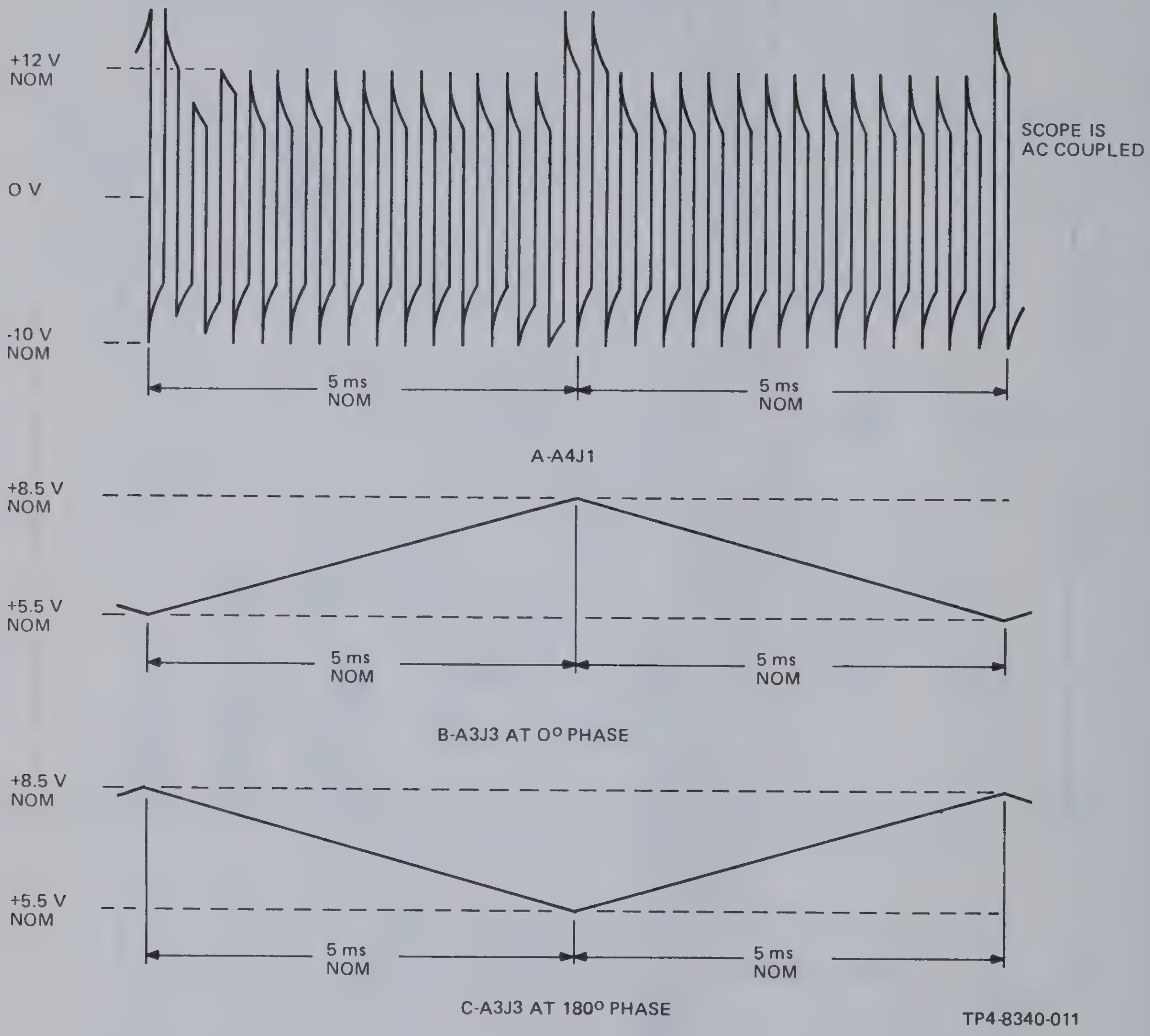
NOTES:

① TEST JACKS POSITIONED IN 60 JACK MATRIX AND ONLY THE JACKS REQUIRED ARE SHOWN.

② IND REQD ONLY FOR ALT-50/55 SYSTEM TEST.

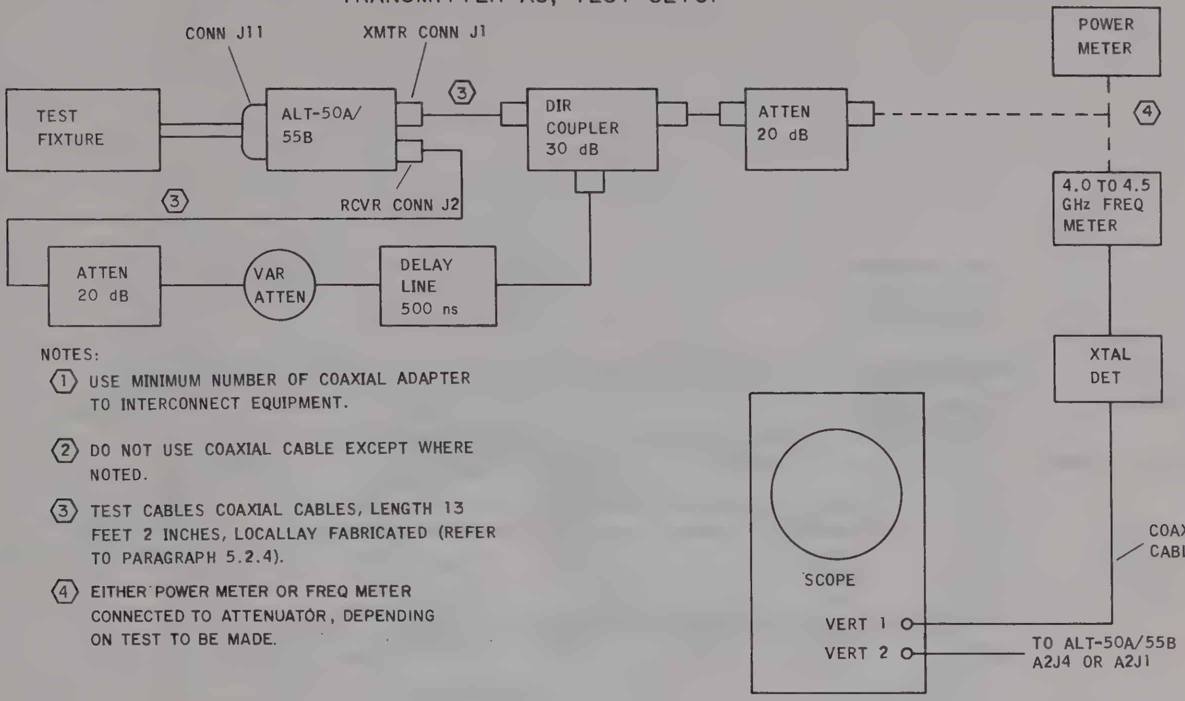
TP4-8366-013

ALT-50A/55B, Test Setup
Figure 5-5



Modulator A3 and Modulator Control A4 Waveforms
Figure 5-6

TRANSMITTER A5, TEST SETUP


CONN J11
XMTR CONN J1
TEST FIXTURE
ALT-50A/ 55B
3
DIR COUPLER 30 dB
ATTEN 20 dB
POWER METER
4
RCVR CONN J2
3
4.0 TO 4.5 GHz FREQ METER
ATTEN 20 dB
VAR ATTEN
DELAY LINE 500 ns
XTAL DET
SCOPE
COAXIAL CABLE
VERT 1
VERT 2
TO ALT-50A/55B A2J4 OR A2J1

NOTES:

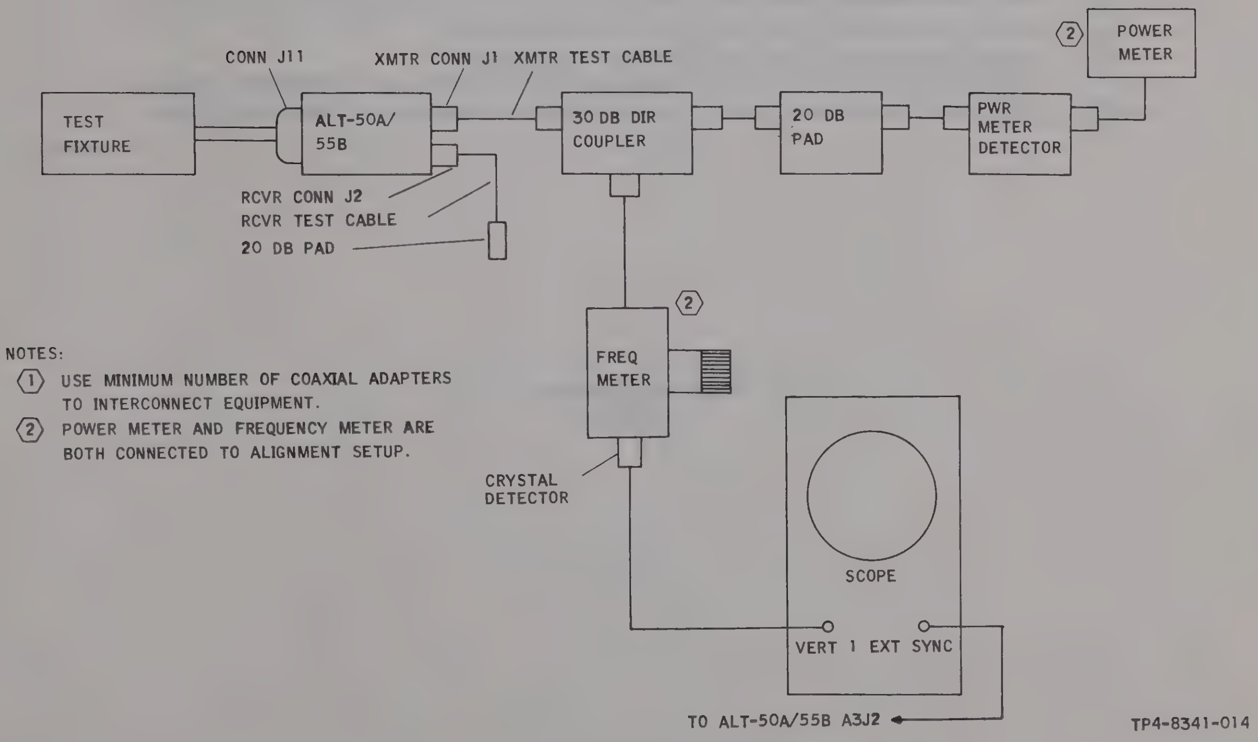
① USE MINIMUM NUMBER OF COAXIAL ADAPTER TO INTERCONNECT EQUIPMENT.

② DO NOT USE COAXIAL CABLE EXCEPT WHERE NOTED.

③ TEST CABLES COAXIAL CABLES, LENGTH 13 FEET 2 INCHES, LOCALLAY FABRICATED (REFER TO PARAGRAPH 5.2.4).

④ EITHER POWER METER OR FREQ METER CONNECTED TO ATTENUATOR, DEPENDING ON TEST TO BE MADE.

TRANSMITTER A5, ALIGNMENT SETUP

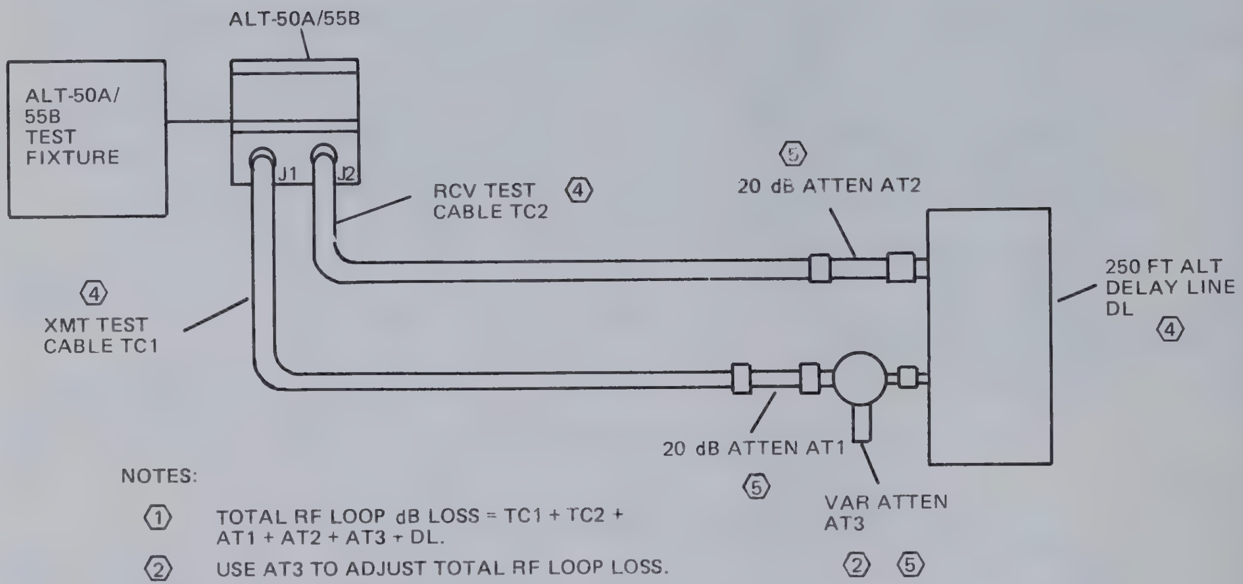

2
POWER METER
CONN J11
XMTR CONN J1
XMTR TEST CABLE
TEST FIXTURE
ALT-50A/ 55B
30 DB DIR COUPLER
20 DB PAD
PWR METER DETECTOR
RCVR CONN J2
RCVR TEST CABLE
20 DB PAD
2
FREQ METER
CRYSTAL DETECTOR
SCOPE
VERT 1
EXT SYNC
TO ALT-50A/55B A3J2
TP4-8341-014

NOTES:

① USE MINIMUM NUMBER OF COAXIAL ADAPTERS TO INTERCONNECT EQUIPMENT.

② POWER METER AND FREQUENCY METER ARE BOTH CONNECTED TO ALIGNMENT SETUP.

Transmitter A5, Test and Alignment Setup
Figure 5-7


ALT-50A/55B
ALT-50A/55B TEST FIXTURE
J1
J2
RCV TEST CABLE TC2 ④
⑤
20 dB ATTEN AT2
250 FT ALT DELAY LINE DL ④
④
XMT TEST CABLE TC1
20 dB ATTEN AT1
⑤
VAR ATTEN AT3
② ⑤

NOTES:

① TOTAL RF LOOP dB LOSS = TC1 + TC2 + AT1 + AT2 + AT3 + DL.

② USE AT3 TO ADJUST TOTAL RF LOOP LOSS.

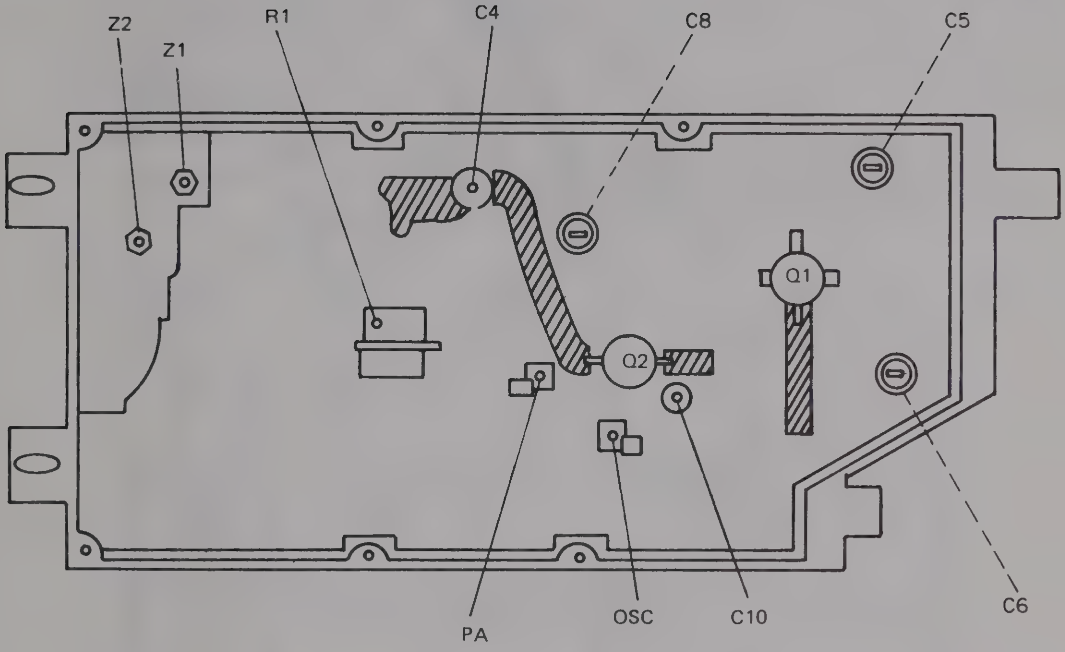
③ TOTAL TIME DELAY = TC1 + TC2 + AT1 + AT2 + AT3 + DL.

④ TEST CABLES AND DELAY LINE MUST BE CALIBRATED FOR dB LOSS AND TIME DELAY. **(TIME DELAY FOR 13' 2" OF RG-214/U AT 4300 MHz = 20.28 ns)**

⑤ USE 1 ns/FT FOR TIME DELAY OF ATTEN. **(EXAMPLE 20 dB ATTEN = 3" TIME DELAY = 0.25 ns)**

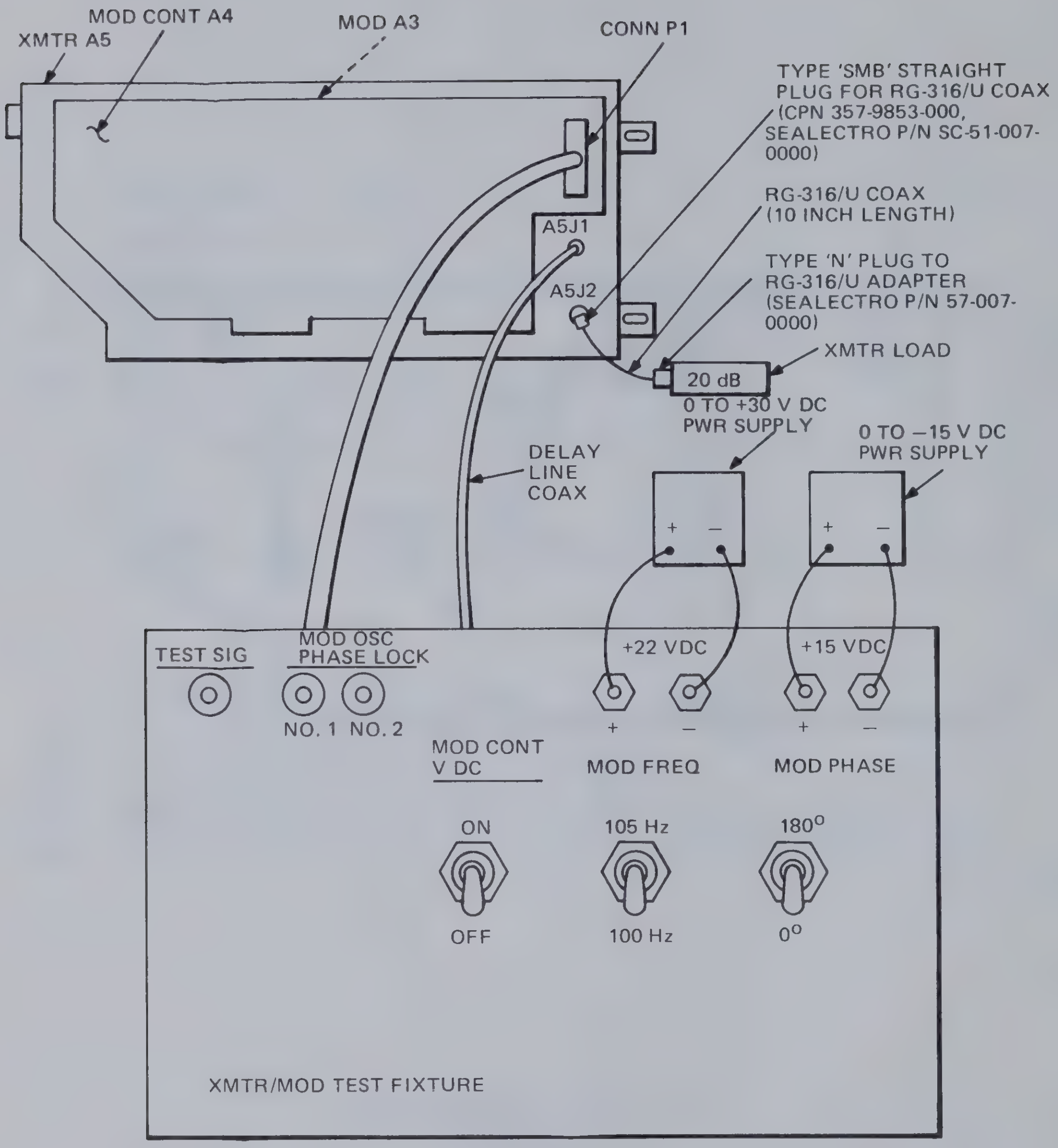
TP4-8348-011-1

RF Loop, Test Setup
Figure 5-8


Z2
Z1
R1
C4
C8
C5
Q1
Q2
PA
OSC
C10
C6

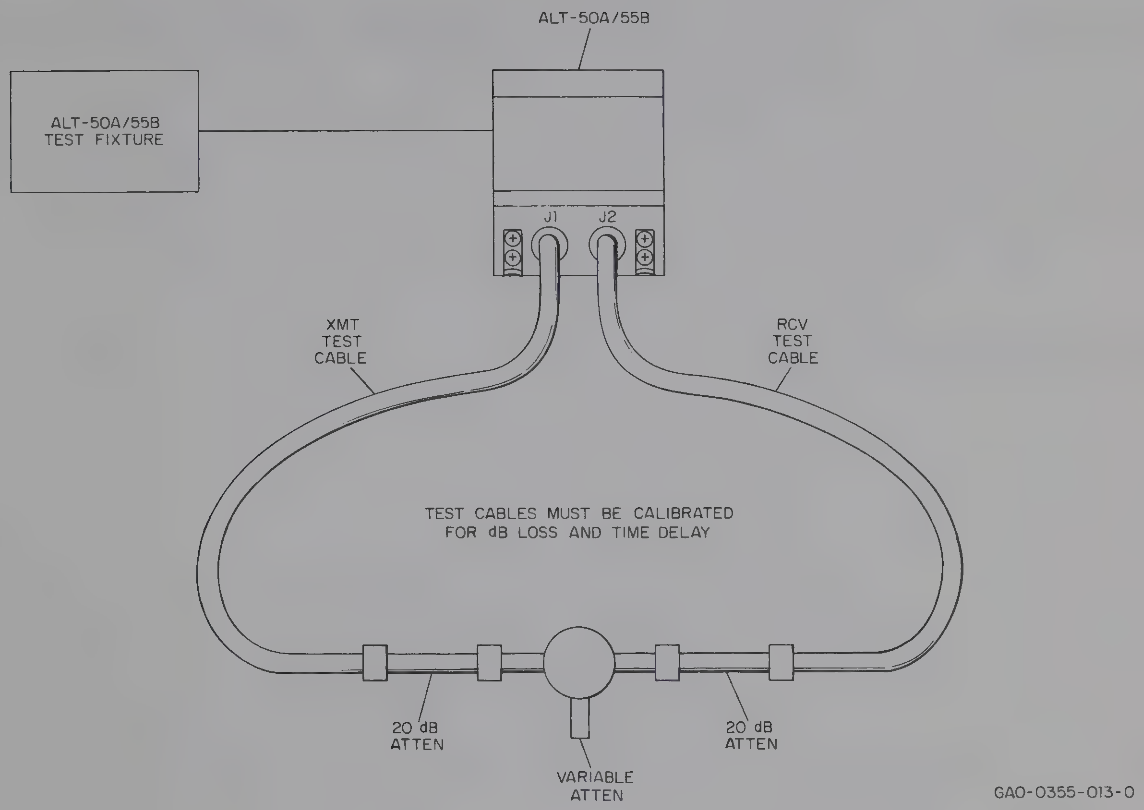
TP4-8343-011

Transmitter A5, Adjustment Locations
Figure 5-9


MOD CONT A4
XMTR A5
MOD A3
CONN P1
TYPE 'SMB' STRAIGHT PLUG FOR RG-316/U COAX (CPN 357-9853-000, SEALECTRO P/N SC-51-007-0000)
RG-316/U COAX (10 INCH LENGTH)
TYPE 'N' PLUG TO RG-316/U ADAPTER (SEALECTRO P/N 57-007-0000)
A5J1
A5J2
XMTR LOAD
20 dB
0 TO +30 V DC PWR SUPPLY
0 TO −15 V DC PWR SUPPLY
DELAY LINE COAX
+
−
+
−
TEST SIG
MOD OSC PHASE LOCK
NO. 1
NO. 2
+22 VDC
+15 VDC
+
−
+
−
MOD CONT V DC
MOD FREQ
MOD PHASE
ON
OFF
105 Hz
100 Hz
180°
0°
XMTR/MOD TEST FIXTURE

TP3-7603-011

Modulator A3, Oscillator Adjustment, Test Setup
Figure 5-10


ALT-50A/55B
ALT-50A/55B TEST FIXTURE
J1
J2
XMT TEST CABLE
RCV TEST CABLE
TEST CABLES MUST BE CALIBRATED FOR dB LOSS AND TIME DELAY
20 dB ATTEN
20 dB ATTEN
VARIABLE ATTEN
GAO-0355-013-0

ALT-50A/55B VSWR Test Setup
Figure 5-11

Collins ALT-50 Radio Altimeter System (With ALT-50A for 2,000-Foot Operation)

Rockwell
International

diagrams

Collins General Aviation Division

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NOTICE: This section replaces fourth edition dated 15 January 1985.

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*6-9	15 Jan 88
6-10 thru 6-11	15 Feb 80
6-12 Blank	31 Aug 76
6-13 thru 6-14	15 Jan 85
*6-15 thru 6-17	15 Jan 88
6-18	15 Jan 85
6-19	15 Feb 80
6-20 Blank	15 Feb 80
*6-21 thru 6-22	15 Jan 88
6-23	15 Feb 80
6-24 Blank	31 Aug 76
6-25 thru 6-26	15 Jan 85
*6-27	15 Jan 88
6-28 thru 6-29	15 Feb 80
6-30 Blank	31 Aug 76
6-31	15 Feb 80
6-32	15 Jan 85
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6-34 Blank	31 Aug 76
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Record of Revisions

RETAIN THIS RECORD IN THE FRONT OF MANUAL.
ON RECEIPT OF REVISIONS, INSERT REVISED PAGES IN THE MANUAL, AND ENTER DATE INSERTED AND INITIALS.

REV NO	REVISION DATE	INSERTION DATE/BY	SB/SIL NUMBER INCLUDED	REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED
1st Ed	31 Aug 76		None				
1	15 Nov 76		None				
2nd Ed	1 Aug 77		ALT-50A SB 1				
3rd Ed	15 Feb 80		SIL 1-79				
4th Ed	15 Jan 85		ALT-50A SB 2				
5th Ed	15 Jan 88		None				

section VI
diagrams

6.1 CONFIGURATION STATUS CONTROL

Collins General Aviation Division of Rockwell International uses the following method for identifying the configuration status of a unit or subassembly.

A 2-character maximum alphabetic identifier will be preceded by the letters REV (revision) and will start with — (dash) if no changes have been processed. The first change will be identified as A, the second as B, and continuing through Y to AA, AB, and ultimately to YY (letters I, O, Q, S, X, and Z are not used).

Incorporation of design changes in a unit or subassembly that has been returned to Collins General Aviation Division for repair by a customer or that has been removed from the company's finished goods inventory is defined as rework. At the time of rework, the unit or subassembly will be marked again to reflect the design level to which it is being upgraded. This is done by leaving the original marking on the unit or subassembly and adding the letters RWK (rework) followed by the alphabetic identifier of the latest change incorporated in the rework. For example, unit one is marked REV B — RWK F and unit two is marked REV F. This indicates that both units are at the design level of revision F, but unit one is reworked and they may not look exactly the same.

Note

> A reworked unit may not contain all design changes made to the reworked identifier, but does contain all changes required to make unit operation identical to a newly manufactured unit with the same identifier. Therefore, a unit reworked to a specific identifier may physically appear different from a newly manufactured unit with the same alphabetic identifier.

Only alphabetic identifiers that result in schematic changes are covered in this section. If a unit or subassembly has an identifier that alphabetically falls between identifiers on the schematic changes pages, or after the last identifier on the schematic changes page up to and including the latest effectivity listed below, the electrical configuration is represented by the earlier identifier listed on the schematic changes page.

6.2 SCHEMATIC DIAGRAMS

The ALT-50A Radio Altimeter Receiver-Transmitter schematic diagrams, voltage/waveform diagrams, electrical components parts lists, and component location diagrams are provided in figures 6-1 through 6-17.

A schematic change sheet precedes each schematic. The change sheet provides a description of schematic changes, a reason for the changes, the service bulletin number (if applicable) that modifies the unit, and the production cut-in effectivity for the change.

6.3 CONFIGURATION EFFECTIVITY

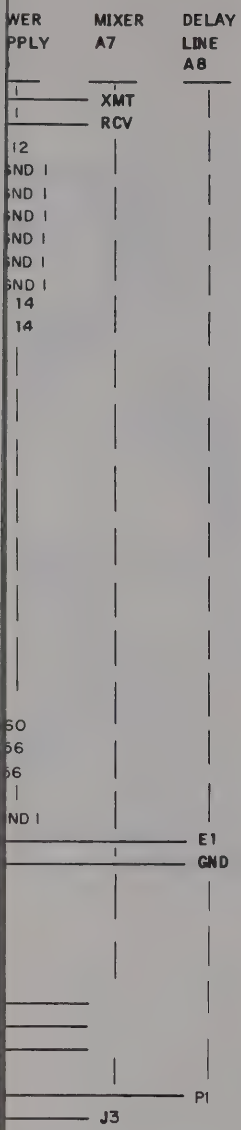
Listed below are the units or subassemblies with the latest identifier (change) covered by this section.

UNIT/SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
ALT-50A Radio Altimeter Receiver-Transmitter	622-3201-001	REV H
ALT-50A Radio Altimeter Receiver-Transmitter	622-3201-002	REV H
Altitude Processor A1	617-9090-003	REV AV
Preamplifier/Filter A2	617-9092-004	REV AV
Modulator A3	617-9311-001	REV AC
Modulator Control A4	617-9313-001	REV U
Transmitter A5	629-7152-001	REV J
Power Supply A6	629-7148-001	REV M
Power Supply Control A6A1	601-2915-001	REV K
Mixer A7	601-2917-001	REV H
Delay Line A8	629-7154-001	REV E

INTERCONNECT WIRING DIAGRAM

REVISION IDENTIFICATION	DESCRIPTION OF REVISION AND REASON FOR CHANGE	SERVICE BULLETIN	EFFECTIVITY
	Below are schematic corrections that apply to all units.		
None	Added notes 6 and 7; deleted J4-2, A3P1-2, and A4P1-2; deleted J3-4 connection to P1-35; added jumper from P1-35 to P1-49; deleted J3-27 connection to P1-51; added J3-27 connection to P1-57; added A8P1, A2P2-5, -9, and A3P1-11.	None	All units

ALT-50A Radio Altimeter Receiver-Transmitter, Interconnect Wiring Diagram
Figure 6-1 (Sheet A)

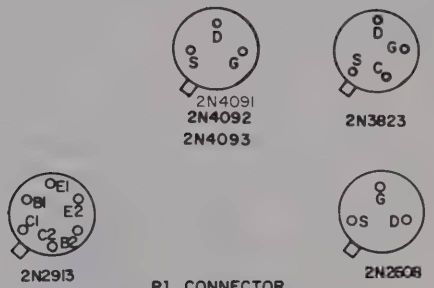

WER
PPLY
MIXER
A7
DELAY
LINE
A8
XMT
RCV
12
GND 1
GND 1
GND 1
GND 1
GND 1
GND 1
14
14
60
56
56
1
ND 1
E1
GND
P1
J3

NOTES:

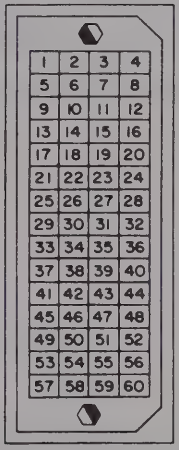
① UNLESS OTHERWISE SPECIFIED; RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS, AND INDUCTANCE VALUES ARE IN MICROHENRY'S.

② RESISTORS DESIGNATED SELECT ARE SELECTED IN TEST.

③ LEAD LOCATION OF DUAL SECTION TRANSISTORS AND FIELD EFFECT TRANSISTORS ARE AS FOLLOWS:


D
S
G
2N4091
2N4092
2N4093
D
G
S
C
2N3823
E1
B1
E2
C1
C2
B2
2N2913
G
S
D
2N2608

P1 CONNECTOR


1 2 3 4
5 6 7 8
9 10 11 12
13 14 15 16
17 18 19 20
21 22 23 24
25 26 27 28
29 30 31 32
33 34 35 36
37 38 39 40
41 42 43 44
45 46 47 48
49 50 51 52
53 54 55 56
57 58 59 60

REAR OF RT VIEW

④ TYPE 555 PWR IS PIN 8 AT 6.5 V PIN 1 IS GND.

⑤ ⌣⌣ SYMBOL INDICATES FERRITE BEAD (CPN 288-0815-010) ON BASE LEADS OF A1Q3 AND A2Q14.

⑥ J1, J2 ARE PART OF MIXER A7.

⑦ P1, J3, J4, J5 ARE PART OF WIRING HARNESS 618-1667-003

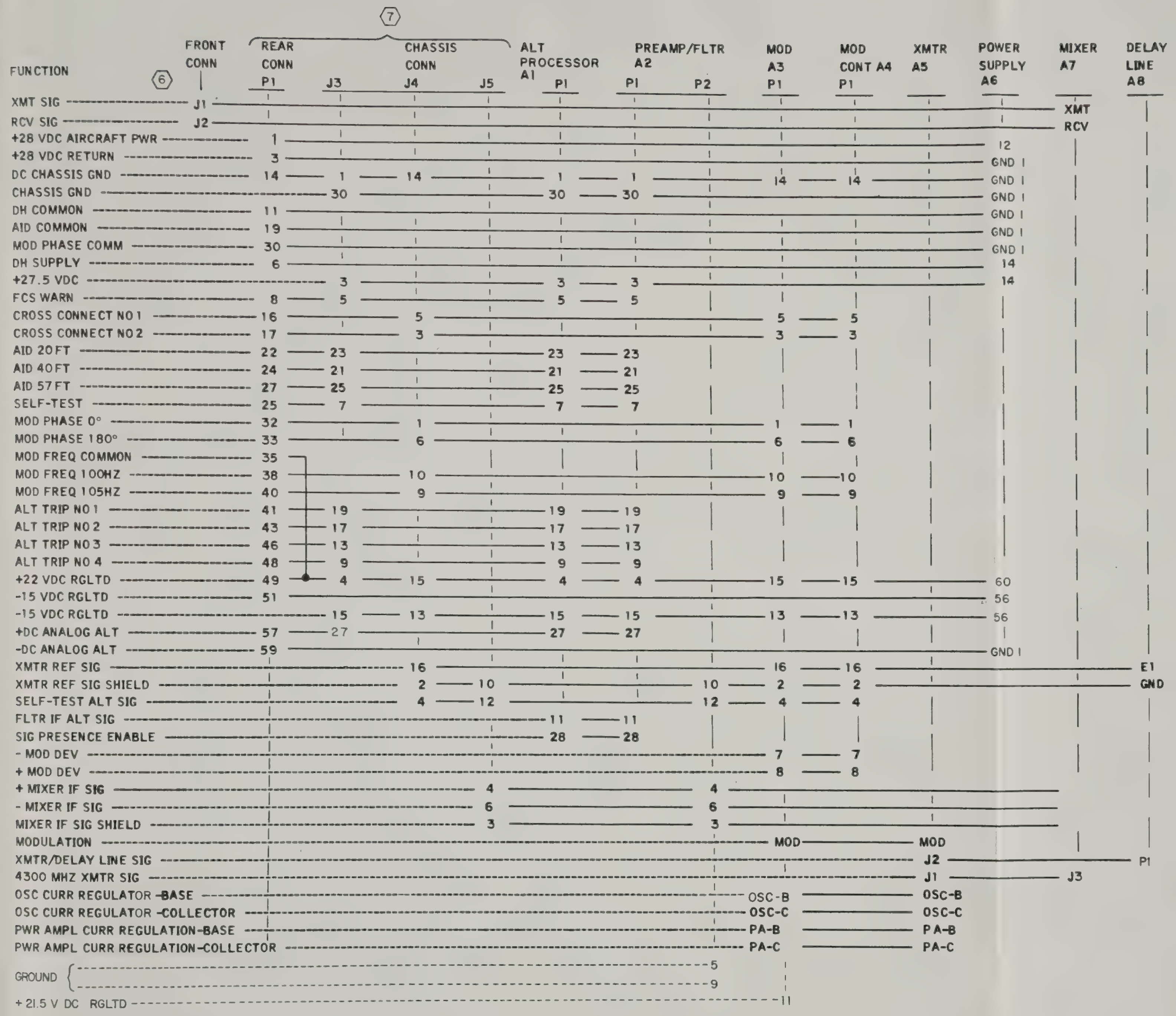
637-2031

ALT-50A Radio Altimeter Receiver-Transmitter,
Interconnect Wiring Diagram
Figure 6-1

INTERCONNECT WIRING DIAGRAM

REVISION IDENTIFICATION	DESCRIPTION OF REVISION AND REASON FOR CHANGE	SERVICE BULLETIN	EFFECTIVITY
	Below are schematic corrections that apply to all units.		
None	Added notes 6 and 7; deleted J4-2, A3P1-2, and A4P1-2; deleted J3-4 connection to P1-35; added jumper from P1-35 to P1-49; deleted J3-27 connection to P1-51; added J3-27 connection to P1-57; added A8P1, A2P2-5, -9, and A3P1-11.	None	All units

ALT-50A Radio Altimeter Receiver-Transmitter, Interconnect Wiring Diagram
Figure 6-1 (Sheet A)



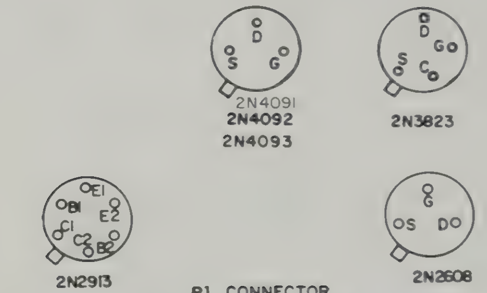
FUNCTION	FRONT CONN ⑥	REAR CONN P1 ⑦	J3	CHASSIS CONN J4	J5	ALT PROCESSOR A1 P1	PREAMP/FLTR A2 P1	PREAMP/FLTR A2 P2	MOD A3 P1	MOD CONT A4 P1	XMTR A5	POWER SUPPLY A6	MIXER A7	DELAY LINE A8
XMT SIG	J1												XMT	
RCV SIG	J2												RCV	
+28 VDC AIRCRAFT PWR		1										12		
+28 VDC RETURN		3										GND I		
DC CHASSIS GND		14	1	14		1	1		14	14		GND I		
CHASSIS GND			30			30	30					GND I		
DH COMMON		11										GND I		
AID COMMON		19										GND I		
MOD PHASE COMM		30										GND I		
DH SUPPLY		6										14		
+27.5 VDC			3			3	3					14		
FCS WARN		8	5			5	5							
CROSS CONNECT NO 1		16		5					5	5				
CROSS CONNECT NO 2		17		3					3	3				
AID 20 FT		22	23			23	23							
AID 40 FT		24	21			21	21							
AID 57 FT		27	25			25	25							
SELF-TEST		25	7			7	7							
MOD PHASE 0°		32		1					1	1				
MOD PHASE 180°		33		6					6	6				
MOD FREQ COMMON		35												
MOD FREQ 100HZ		38		10					10	10				
MOD FREQ 105HZ		40		9					9	9				
ALT TRIP NO 1		41	19			19	19							
ALT TRIP NO 2		43	17			17	17							
ALT TRIP NO 3		46	13			13	13							
ALT TRIP NO 4		48	9			9	9							
+22 VDC RGLTD		49	4	15		4	4		15	15		60		
-15 VDC RGLTD		51										56		
-15 VDC RGLTD			15	13		15	15		13	13		56		
+DC ANALOG ALT		57	27			27	27							
-DC ANALOG ALT		59										GND I		
XMTR REF SIG				16					16	16				E1
XMTR REF SIG SHIELD				2	10			10	2	2				GND
SELF-TEST ALT SIG				4	12			12	4	4				
FLTR IF ALT SIG						11	11							
SIG PRESENCE ENABLE						28	28							
- MOD DEV									7	7				
+ MOD DEV									8	8				
+ MIXER IF SIG					4			4						
- MIXER IF SIG					6			6						
MIXER IF SIG SHIELD					3			3						
MODULATION									MOD		MOD			
XMTR/DELAY LINE SIG											J2			P1
4300 MHZ XMTR SIG											J1		J3	
OSC CURR REGULATOR -BASE									OSC-B		OSC-B			
OSC CURR REGULATOR -COLLECTOR									OSC-C		OSC-C			
PWR AMPL CURR REGULATION-BASE									PA-B		PA-B			
PWR AMPL CURR REGULATION-COLLECTOR									PA-C		PA-C			
GROUND								5 9						
+ 21.5 V DC RGLTD									11					

NOTES:

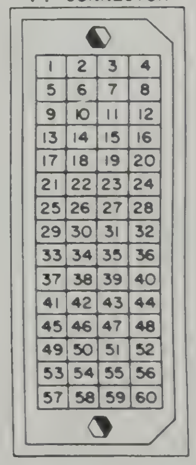
① UNLESS OTHERWISE SPECIFIED; RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS, AND INDUCTANCE VALUES ARE IN MICROHENRY'S.

② RESISTORS DESIGNATED SELECT ARE SELECTED IN TEST.

③ LEAD LOCATION OF DUAL SECTION TRANSISTORS AND FIELD EFFECT TRANSISTORS ARE AS FOLLOWS:



P1 CONNECTOR



REAR OF RT VIEW

④ TYPE 555 PWR IS PIN 8 AT 6.5 V PIN 1 IS GND.

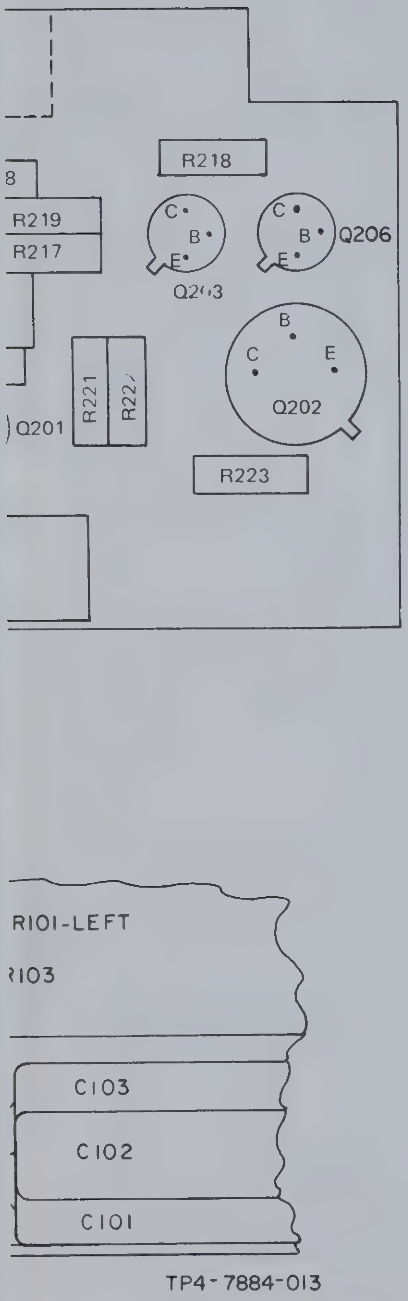
⑤ ◡◡ SYMBOL INDICATES FERRITE BEAD (CPN 288-0815-010) ON BASE LEADS OF A1Q3 AND A2Q14.

⑥ J1, J2 ARE PART OF MIXER A7

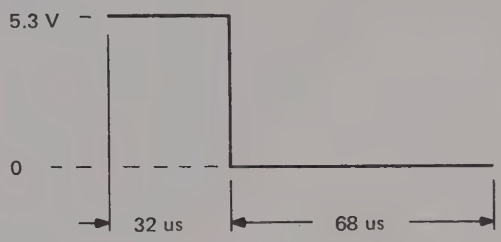
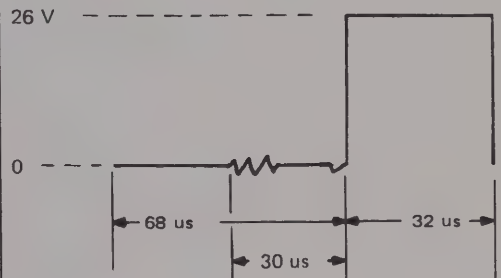
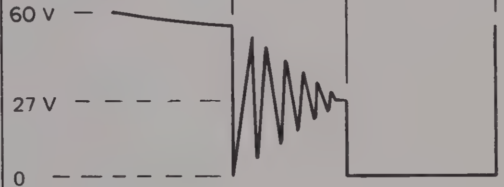
⑦ P1, J3, J4, J5 ARE PART OF WIRING HARNESS 618-1667-003

637-2031

ALT-50A Radio Altimeter Receiver-Transmitter, Interconnect Wiring Diagram
Figure 6-1

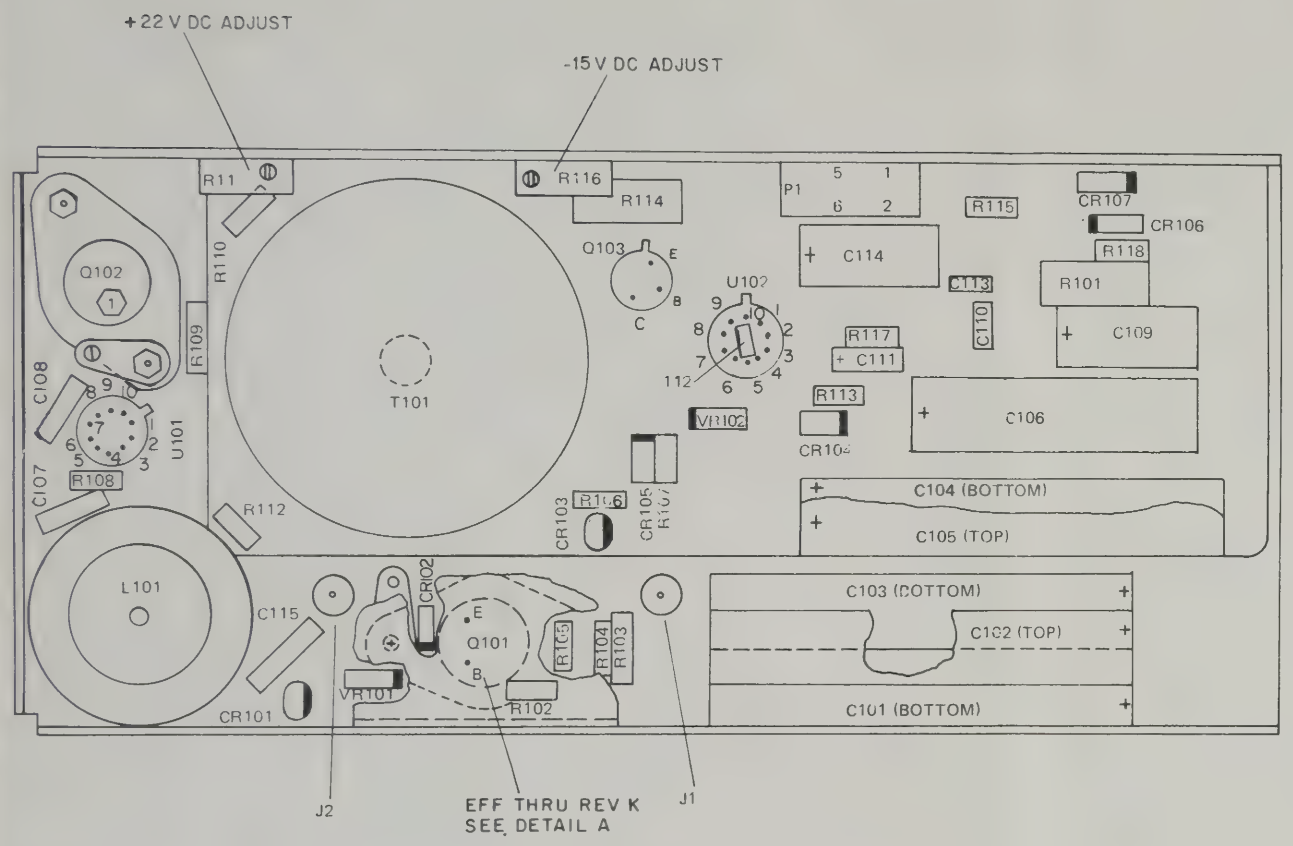

R218
8
R219
R217
C
B
E
Q203
C
B
E
Q206
B
C
E
Q202
R221
R22
Q201
R223
RIOI-LEFT
103
C103
C102
C101
TP4-7884-013

Power Supply A6 and Power Supply Control Card A6A1,
Component Location Diagram
Figure 6-2

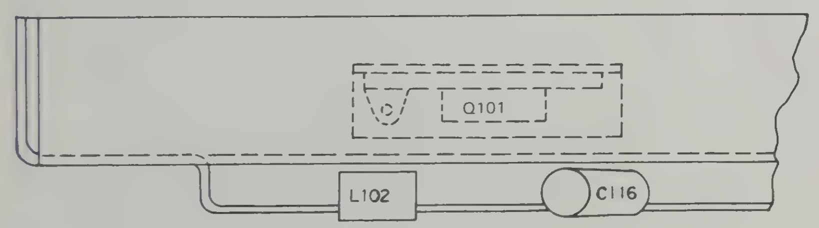
TEST POINT	TYPICAL WAVEFORM OR NOMINAL VOLTAGE	TEST POINT	TYPICAL WAVEFORM OR NOMINAL VOLTAGE
	INPUT: +28.003 VDC PR		
	POWER SUPPLY A6		POWER SUPPLY A6
J1	+0.0940 V DC		
J2	+27.11 V DC		
CR201-A	+7.248 V DC		
U203-2	+3.997 V DC		
U203-3	+5.506 V DC	U202-3	
Q205-B	+6.48 V DC		
Q205-E	+6.553 V DC		
U202-5	+3.831 V DC		
Q203-B	+5.95 V DC		
Q101-B	+0.6905 V DC		
Q101-E	+0.0944 V DC	Q202-C	
Q103-C	+5.25 V DC		
Q103-E	+0.336 V DC		
Q203-E	+6.555 V DC		
Q201-E	+0.0067 V DC		
Q204-B	+0.668 V DC		
Q202-B	+26.16 V DC		
Q202-E	+26.44 V DC	T101-6 (CR102-A)	

TP4-8441-013

Power Supply A6 and Power Supply Control Card A6A1, Voltages and Waveforms
Figure 6-3

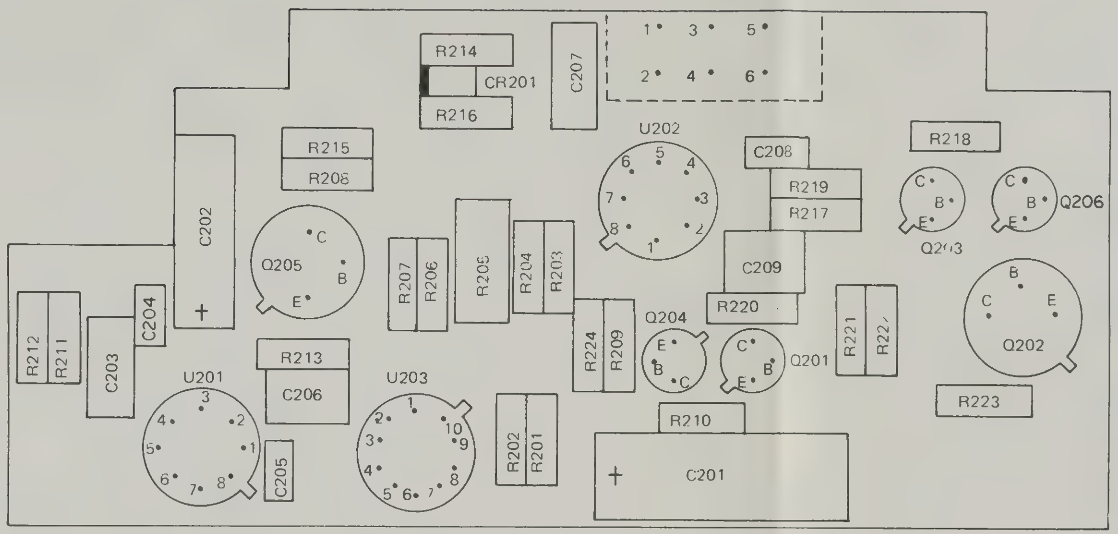

+22 V DC ADJUST
-15 V DC ADJUST
R11
R116
R114
P1
5 1
6 2
R115
CR107
CR106
R118
R101
C109
C114
C113
C110
R117
C111
R113
C106
VR102
CR104
Q103
U102
Q102
T101
R110
R109
C108
U101
C107
R108
R112
CR103
R106
CR105
R107
C104 (BOTTOM)
C105 (TOP)
L101
C115
CR102
Q101
R105
R104
R103
C103 (BOTTOM)
C102 (TOP)
C101 (BOTTOM)
CR101
VR101
R102
J2
J1
EFF THRU REV K
SEE DETAIL A

POWER SUPPLY A6

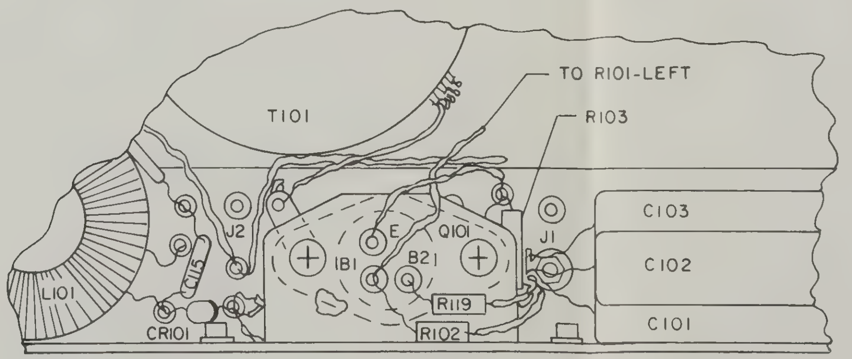

Q101
L102
C116

NOTE:

① NOTE PLACEMENT AND SEQUENCE OF MOUNTING HARDWARE (WASHERS, INSULATORS, ETC) BEFORE REMOVING Q102


R214
CR201
R216
C207
R215
R208
U202
C208
R219
R217
R218
Q203
Q206
C202
Q205
R207
R206
R205
R204
R203
C209
R220
R212
R211
C203
C204
R213
C206
U201
U203
R224
R209
Q204
Q201
R221
R222
Q202
R210
C201
R223
C205
R202
R201

POWER SUPPLY CONTROL CARD A6A1

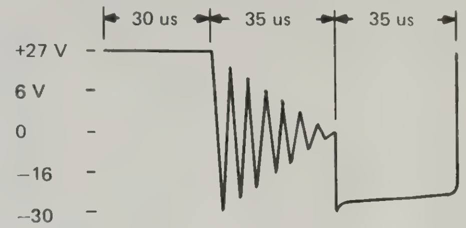

TO R101-LEFT
R103
T101
J2
Q101
J1
C103
C102
C101
L101
C115
CR101
R119
R102

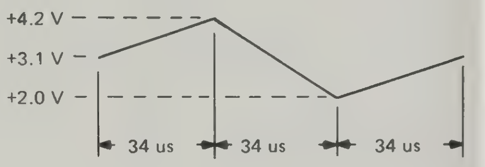
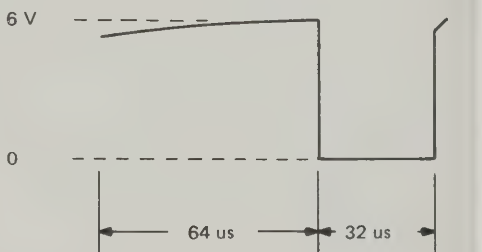
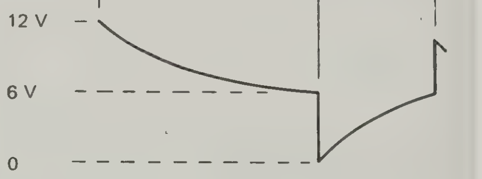
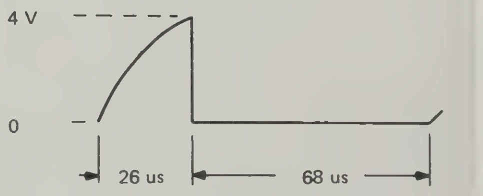
DETAIL A, EFF REV L, SB2

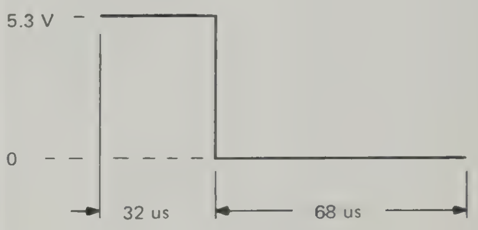
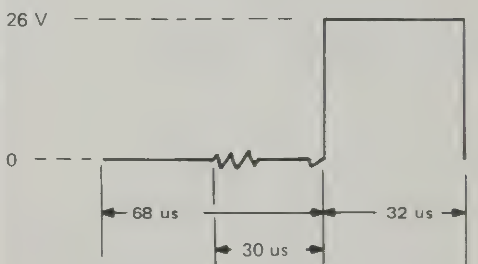
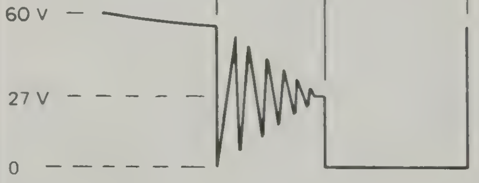
TP4-7884-013

Power Supply A6 and Power Supply Control Card A6A1, Component Location Diagram
Figure 6-2

TEST POINT	TYPICAL WAVEFORM OR NOMINAL VOLTAGE
	INPUT: +28.003 VDC PRIMARY POWER
	POWER SUPPLY A6
J1	+0.0940 V DC
J2	+27.11 V DC
CR201-A	+7.248 V DC
U203-2	+3.997 V DC
U203-3	+5.506 V DC
Q205-B	+6.48 V DC
Q205-E	+6.553 V DC
U202-5	+3.831 V DC
Q203-B	+5.95 V DC
Q101-B	+0.6905 V DC
Q101-E	+0.0944 V DC
Q103-C	+5.25 V DC
Q103-E	+0.336 V DC
Q203-E	+6.555 V DC
Q201-E	+0.0067 V DC
Q204-B	+0.668 V DC
Q202-B	+26.16 V DC
Q202-E	+26.44 V DC

TEST POINT	TYPICAL WAVEFORM OR NOMINAL VOLTAGE
	INPUT: +28.003 VDC PRIMARY POWER
	POWER SUPPLY A6
T101-2 (CR103-A)	 30 us 35 us 35 us +27 V 6 V 0 −16 −30
U101-1	+22.00 V DC
U101-2	+7.150 V DC
U101-3	+7.157 V DC
U101-4	+7.158 V DC
U101-6	+23.20 V DC
U101-7 U101-8	+27.09 V DC
U101-9	+24.4 V DC
U101-10	+22.42 V DC
U102-2	−7.377 V DC
U102-3	−7.874 V DC
U102-4	−7.864 V DC
U102-6	+0.9982 V DC
U102-7 U102-8	+5.267 V DC
U102-9	+2.206 V DC
U102-10	+0.337 V DC

TEST POINT	TYPICAL WAVEFORM OR NOMINAL VOLTAGE
	INPUT: +28.003 VDC PRIMARY POWER
	POWER SUPPLY A6
CR101-C	+27.21 V DC
U201-6	 +4.2 V +3.1 V +2.0 V 34 us 34 us 34 us
U201-3	 6 V 0 64 us 32 us
U202-2	
U202-7	 4 V 0 26 us 68 us

TEST POINT	TYPICAL WAVEFORM OR NOMINAL VOLTAGE
	POWER SUPPLY A6
U202-3	 5.3 V 0 32 us 68 us
Q202-C	 26 V 0 68 us 32 us 30 us
T101-6 (CR102-A)	

TP4-8441-013

Power Supply A6 and Power Supply Control Card A6A1,
Voltages and Waveforms
Figure 6-3

SCHEMATIC CHANGES

REVISION IDENTIFICATION	DESCRIPTION OF REVISION AND REASON FOR CHANGE	SERVICE BULLETIN	EFFECTIVITY
None	Connector A6P1 added between A6 and A6A1, schematic correction.	None	All
C1	Changed A6A1R206 from 46.4 kΩ to 45.3 kΩ to improve power supply turn-on voltage.	None	A6A1 601-2915-001 REV G
C2	Changed A6R115 from 4220 to 4020 ohms; changed A6R116 from 500 to 1000 ohms; changed A6R117 from 4120 to 4020 ohms to improve adjustment range of -15-V dc regulator.	None	A6 629-7148-001 REV H
D1	Changed Q101 from 2N6301 to U2T201 and added R119 to improve power supply reliability.	2	A6 629-7148-001 REV L
D2	Changed R212 from 48.7 kΩ to test select to allow for alternate vendor types of U201.	None	A6A1 601-2915-001 REV J

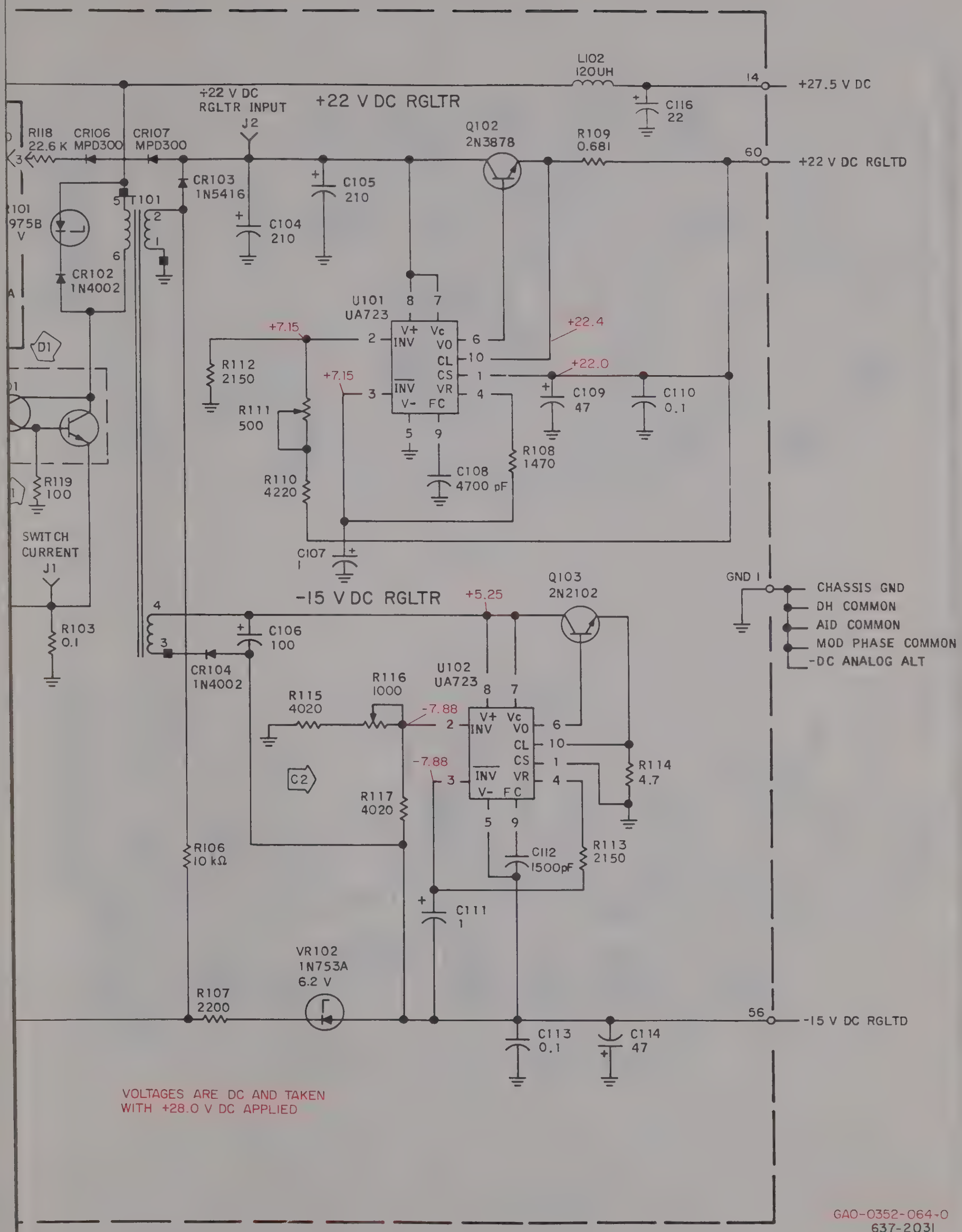
Power Supply A6 and Power Supply Control Card A6A1, Schematic Diagram
Figure 6-4 (Sheet A)

PARTS LIST
POWER SUPPLY CHASSIS ASSEMBLY A6 (PART NUMBER 629-7148-001)
LATEST EFFECTIVITY: REV M

SYMBOL	DESCRIPTION	PART NUMBER
C101	Capacitor, fixed, electrolytic, 210μF, -10% +75%, 40V	183-1277-310
C102	Capacitor, fixed, electrolytic, 210μF, -10% +75%, 40V	183-1277-310
C103	Capacitor, fixed, electrolytic, 210μF, -10% +75%, 40V	183-1277-310
C104	Capacitor, fixed, electrolytic, 210μF, -10% +75%, 40V	183-1277-310
C105	Capacitor, fixed, electrolytic, 210μF, -10% +75%, 40V	183-1277-310
C106	Capacitor, fixed, electrolytic, 100μF, -10% +75%, 40V	183-1277-300
C107	Capacitor, fixed, electrolytic, 1μF, 20%, 35V	184-7398-000
C108	Capacitor, fixed, ceramic dielectric, 4700pF, 10%, 100V	913-5019-160
C109	Capacitor, fixed, electrolytic, 47μF, 20%, 35V	184-7411-000
C110	Capacitor, fixed, ceramic dielectric, 0.1μF, 10%, 50V	913-5019-320
C111	Capacitor, fixed, electrolytic, 1μF, 20%, 35V	184-7398-000
C112	Capacitor, fixed, ceramic dielectric, 1500pF, 10%, 100V	913-5019-100
C113	Capacitor, fixed, ceramic dielectric, 0.1μF, 10%, 50V	913-5019-320
C114	Capacitor, fixed, electrolytic, 47μF, 20%, 35V	184-7411-000
C115	Capacitor, fixed, ceramic dielectric, 0.02μF, -20% +80%, 100V	913-3678-000
C116	Capacitor, fixed, electrolytic, 22μF, 10%, 50V	184-9087-670
CR101	Diode, 1N5552	353-3718-060
CR102	Diode, 1N4002	353-6442-020
CR103	Diode, 1N5416	353-6558-020
CR104	Diode, 1N4002	353-6442-020
CR105	Diode, 1N4454	353-3644-010
CR106	Diode, MPD300	353-3723-020
CR107	Diode, MPD300	353-3723-020
J1	Jack, white	306-2241-100
J2	Jack, white	306-2241-100
L101	Coil, 1.5MH	797-7106-001
L102	Coil, 0.12MH	668-0252-030
P1	Connector	621-7567-003
Q101	Transistor, 2N6301 (eff to REV L)	352-1014-030
Q101	Transistor, U2T201 (eff REV L SB 2)	352-1008-010
Q102	Transistor, 2N3878	352-0704-010
Q103	Transistor, 2N2102	352-0646-010
R101	Resistor, fixed, wire-wound, 330Ω, 5%, 3W	747-5388-000
R102	Resistor, fixed, composition, 330Ω, 10%, 1/4W	745-0731-000
R103	Resistor, fixed, wire-wound, 0.1Ω, 1%, 2.25W	746-3155-070
R104	Resistor, fixed, composition, 4700Ω, 10%, 1/4W	745-0773-000
R105	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R106	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R107	Resistor, fixed, composition, 2200Ω, 10%, 1/4W	745-0761-000
R108	Resistor, fixed, film, 1470Ω, 1%, 1/8W	705-1004-000
R109	Resistor, fixed, wire-wound 0.681Ω, 1%, 3W (eff to REV E)	747-2173-410
R109	Resistor, fixed, wire-wound, 0.681Ω, 1%, 3W (eff REV E)	747-7600-340
R110	Resistor, fixed, film, 4220Ω, 1%, 1/8W	705-1026-000
R111	Resistor, variable, wire-wound, 500Ω, 5%, 3/4W	381-1721-090
R112	Resistor, fixed, film, 2150Ω, 1%, 1/8W	705-1012-000
R113	Resistor, fixed, film, 2150Ω, 1%, 1/8W	705-1012-000
R114	Resistor, fixed, wire-wound, 4.7Ω, 5%, 3W	747-5368-000
R115	Resistor, fixed, film, 4220Ω, 1%, 1/8W (eff to REV H)	705-1026-000
R115	Resistor, fixed, film, 4020Ω, 1%, 1/8W (eff REV H)	705-1025-000
R116	Resistor, variable, wire-wound, 500Ω, 5%, 3/4W (eff to REV H)	381-1721-090
R116	Resistor, variable, wire-wound, 1000Ω, 5%, 3/4W (eff REV H)	381-1721-100
R117	Resistor, fixed, film, 4120Ω, 1%, 1/8W (eff to REV G)	705-1468-230
R117	Resistor, fixed, film, 4120Ω, 1%, 1/8W (eff REV G)	705-3605-290
R117	Resistor, fixed, film, 4020Ω, 1%, 1/8W (eff REV H)	705-1025-000
R118	Resistor, fixed, film, 22.6kΩ, 1%, 1/8W	705-1061-000
R119	Resistor, fixed, composition, 100Ω, 5%, 1/4W (eff REV L)	745-0712-000
T101 or,	Transformer, power	662-0894-010
T101	Transformer, power	629-7529-001
U101	Integrated circuit, UA723	351-1035-010
U102	Integrated circuit, UA723	351-1035-010
VR101	Zener diode, 1N975B, 39V	353-3186-000
VR102	Zener diode, 1N753A, 6.2V	353-2714-000

POWER SUPPLY CONTROL CARD ASSEMBLY A6A1 (PART NUMBER 601-2915-001)
LATEST EFFECTIVITY: REV K

SYMBOL	DESCRIPTION	PART NUMBER
C201	Capacitor, fixed, electrolytic, 10μF, 10%, 50V	184-9087-610
C202	Capacitor, fixed, electrolytic, 22μF, 10%, 15V	184-9086-310
C203	Capacitor, fixed, mica dielectric, 1000pF, 2%, 100V	912-2093-100
C204	Capacitor, fixed, ceramic dielectric, 0.01μF, 10%, 100V	913-5019-200
C205	Capacitor, fixed, ceramic dielectric, 0.022μF, 10%, 50V	913-5019-240
C206	Capacitor, fixed, mica dielectric, 330pF, 5%, 50V	912-4141-490
C207	Capacitor, fixed, mica dielectric, 1000pF, 2%, 100V	912-2093-100
C208	Capacitor, fixed, ceramic dielectric, 0.01μF, 10%, 100V	913-5019-200
C209	Capacitor, fixed, mica dielectric, 33pF, 5%, 50V	912-4141-220
CR201	Diode, 1N4454	353-3644-010
Q201	Transistor, 2N2222A	352-0661-020
Q202	Transistor, 2N2905A	352-0550-000
Q203	Transistor, 2N2907A	352-0551-000
Q204	Transistor, 2N2222A	352-0661-020
Q205	Transistor, 2N2219A	352-0661-010
Q206	Transistor, 2N2222A	352-0661-020
R201	Resistor, fixed, film, 61.9kΩ, 1%, 1/8W	705-1082-000
R202	Resistor, fixed, film, 44.2kΩ, 1%, 1/8W	705-1075-000
R203	Resistor, fixed, film, 27.4kΩ, 1%, 1/8W	705-1065-000
R204	Resistor, fixed, film, 261kΩ, 1%, 1/8W	705-1112-000
R205	Resistor, fixed, composition, 2200Ω, 10%, 1/2W	745-1366-000
R206	Resistor, fixed, film, 46.4kΩ, 1%, 1/8W (eff to REV G)	705-1076-000
R206	Resistor, fixed, film, 45.3kΩ, 1%, 1/8W (eff REV G)	705-3605-790
R207	Resistor, fixed, film, 36.5kΩ, 1%, 1/8W	705-1071-000
R208	Resistor, fixed, composition, 47Ω, 10%, 1/4W	745-0701-000
R209	Resistor, fixed, composition, 2200Ω, 10%, 1/4W	745-0761-000
R210	Resistor, fixed, composition, 470Ω, 10%, 1/4W	745-0737-000
R211	Resistor, fixed, film, 46.4kΩ, 1%, 1/8W	705-1076-000
R212	Resistor, fixed, film, 48.7kΩ, 1%, 1/8W	705-1077-000
R212	Test selected (eff REV J)	
	Resistor, fxd, film, 45.3kΩ	705-3605-790
	Resistor, fxd, film, 46.4kΩ	705-1076-000
	Resistor, fxd, film, 47.5kΩ	705-3605-800
	Resistor, fxd, film, 48.7kΩ	705-1077-000
	Resistor, fxd, film, 49.9kΩ	705-3605-810
	Resistor, fxd, film, 51.1kΩ	705-1078-000
R213	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R214	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R215	Resistor, fixed, composition, 1000Ω, 10%, 1/4W	745-0749-000
R216	Resistor, fixed, film, 30.1kΩ, 1%, 1/8W	705-1067-000
R217	Resistor, fixed, film, 187Ω, 1%, 1/8W	705-0961-000
R218	Resistor, fixed, film, 7500Ω, 1%, 1/8W	705-1038-000
R219	Resistor, fixed, film, 2490Ω, 1%, 1/8W	705-1015-000
R220	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R221	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R222	Resistor, fixed, composition, 6800Ω, 10%, 1/4W	745-0779-000
R223	Resistor, fixed, composition, 2200Ω, 10%, 1/4W	745-0761-000
R224	Resistor, fixed, composition, 220kΩ, 10%, 1/4W	745-0833-000
U201	Integrated circuit, 555	351-1137-080
U202	Integrated circuit, 555	351-1137-080
U203	Integrated circuit, UA723	351-1035-010


L102
120UH
C116
22
14
+27.5 V DC
+22 V DC
RGLTR INPUT
J2
+22 V DC RGLTR
Q102
2N3878
R109
0.681
60
+22 V DC RGLTD
R118
22.6 K
CR106
MPD300
CR107
MPD300
CR103
1N5416
C105
210
C104
210
T101
5
2
1
6
975B
V
CR102
1N4002
D1
U101
UA723
8
7
+7.15
2
INV
V+
Vc
VO
6
CL
10
CS
1
VR
4
V-
FC
3
5
9
+22.4
+22.0
R112
2150
+7.15
R111
500
R110
4220
C109
47
C110
0.1
R108
1470
C108
4700 pF
C107
1
R119
100
SWITCH
CURRENT
J1
R103
0.1
-15 V DC RGLTR
+5.25
Q103
2N2102
4
3
C106
100
CR104
1N4002
GND 1
CHASSIS GND
DH COMMON
AID COMMON
MOD PHASE COMMON
-DC ANALOG ALT
R116
1000
U102
UA723
R115
4020
-7.88
-7.88
C2
R117
4020
R114
4.7
R113
2150
C112
1500pF
C111
1
R106
10 kΩ
VR102
1N753A
6.2 V
R107
2200
56
-15 V DC RGLTD
C113
0.1
C114
47
VOLTAGES ARE DC AND TAKEN
WITH +28.0 V DC APPLIED

GA0-0352-064-0
637-2031

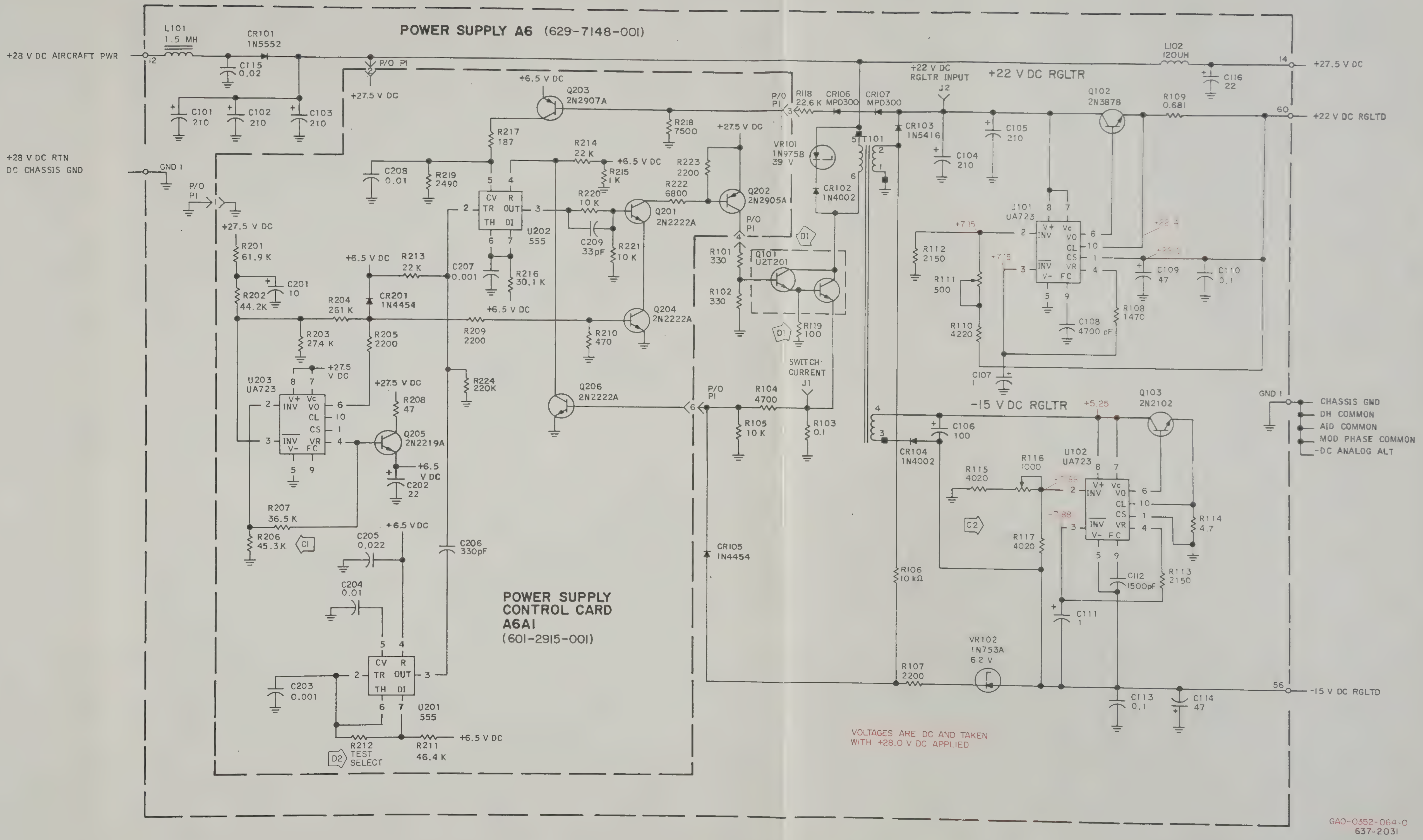
Power Supply A6 and Power Supply Control Card A6A1, Schematic Diagram
Figure 6-4

PARTS LIST
POWER SUPPLY CHASSIS ASSEMBLY A6 (PART NUMBER 629-7148-001)
LATEST EFFECTIVITY: REV M

SYMBOL	DESCRIPTION	PART NUMBER
C101	Capacitor, fixed, electrolytic, 210μF, -10%+75%, 40V	183-1277-310
C102	Capacitor, fixed, electrolytic, 210μF, -10%+75%, 40V	183-1277-310
C103	Capacitor, fixed, electrolytic, 210μF, -10%+75%, 40V	183-1277-310
C104	Capacitor, fixed, electrolytic, 210μF, -10%+75%, 40V	183-1277-310
C105	Capacitor, fixed, electrolytic, 210μF, -10%+75%, 40V	183-1277-310
C106	Capacitor, fixed, electrolytic, 100μF, -10%+75%, 40V	183-1277-300
C107	Capacitor, fixed, electrolytic, 1μF, 20%, 35V	184-7398-000
C108	Capacitor, fixed, ceramic dielectric, 4700pF, 10%, 100V	913-5019-160
C109	Capacitor, fixed, electrolytic, 47μF, 20%, 35V	184-7411-000
C110	Capacitor, fixed, ceramic dielectric, 0.1μF, 10%, 50V	913-5019-320
C111	Capacitor, fixed, electrolytic, 1μF, 20%, 35V	184-7398-000
C112	Capacitor, fixed, ceramic dielectric, 1500pF, 10%, 100V	913-5019-100
C113	Capacitor, fixed, ceramic dielectric, 0.1μF, 10%, 50V	913-5019-320
C114	Capacitor, fixed, electrolytic, 47μF, 20%, 35V	184-7411-000
C115	Capacitor, fixed, ceramic dielectric, 0.02μF, -20%+80%, 100V	913-3678-000
C116	Capacitor, fixed, electrolytic, 22μF, 10%, 50V	184-9087-670
CR101	Diode, 1N5552	353-3718-060
CR102	Diode, 1N4002	353-6442-020
CR103	Diode, 1N5416	353-6558-020
CR104	Diode, 1N4002	353-6442-020
CR105	Diode, 1N4454	353-3644-010
CR106	Diode, MPD300	353-3723-020
CR107	Diode, MPD300	353-3723-020
J1	Jack, white	306-2241-100
J2	Jack, white	306-2241-100
L101	Coil, 1.5MH	797-7106-001
L102	Coil, 0.12MH	668-0252-030
P1	Connector	621-7567-003
Q101	Transistor, 2N6301 (eff to REV L)	352-1014-030
Q101	Transistor, U2T201 (eff REV L SB 2)	352-1008-010
Q102	Transistor, 2N3878	352-0704-010
Q103	Transistor, 2N2102	352-0646-010
R101	Resistor, fixed, wire-wound, 330Ω, 5%, 3W	747-5388-000
R102	Resistor, fixed, composition, 330Ω, 10%, 1/4W	745-0731-000
R103	Resistor, fixed, wire-wound, 0.1Ω, 1%, 2.25W	746-3155-070
R104	Resistor, fixed, composition, 4700Ω, 10%, 1/4W	745-0773-000
R105	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R106	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R107	Resistor, fixed, composition, 2200Ω, 10%, 1/4W	745-0761-000
R108	Resistor, fixed, film, 1470Ω, 1%, 1/8W	705-1004-000
R109	Resistor, fixed, wire-wound 0.681Ω, 1%, 3W (eff to REV E)	747-2173-410
R109	Resistor, fixed, wire-wound, 0.681Ω, 1%, 3W (eff REV E)	747-7600-340
R110	Resistor, fixed, film, 4220Ω, 1%, 1/8W	705-1026-000
R111	Resistor, variable, wire-wound, 500Ω, 5%, 3/4W	381-1721-090
R112	Resistor, fixed, film, 2150Ω, 1%, 1/8W	705-1012-000
R113	Resistor, fixed, film, 2150Ω, 1%, 1/8W	705-1012-000
R114	Resistor, fixed, wire-wound, 4.7Ω, 5%, 3W	747-5368-000
R115	Resistor, fixed, film, 4220Ω, 1%, 1/8W (eff to REV H)	705-1026-000
R115	Resistor, fixed, film, 4020Ω, 1%, 1/8W (eff REV H)	705-1025-000
R116	Resistor, variable, wire-wound, 500Ω, 5%, 3/4W (eff to REV H)	381-1721-090
R116	Resistor, variable, wire-wound, 1000Ω, 5%, 3/4W (eff REV H)	381-1721-100
R117	Resistor, fixed, film, 4120Ω, 1%, 1/8W (eff to REV G)	705-1468-230
R117	Resistor, fixed, film, 4120Ω, 1%, 1/8W (eff REV G)	705-3605-290
R117	Resistor, fixed, film, 4020Ω, 1%, 1/8W (eff REV H)	705-1025-000
R118	Resistor, fixed, film, 22.6kΩ, 1%, 1/8W	705-1061-000
R119	Resistor, fixed, composition, 100Ω, 5%, 1/4W (eff REV L)	745-0712-000
T101 or,	Transformer, power	662-0894-010
T101	Transformer, power	629-7529-001
U101	Integrated circuit, UA723	351-1035-010
U102	Integrated circuit, UA723	351-1035-010
VR101	Zener diode, 1N975B, 39V	353-3186-000
VR102	Zener diode, 1N753A, 6.2V	353-2714-000

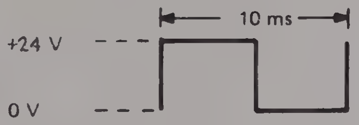
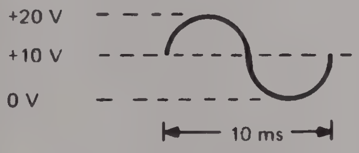
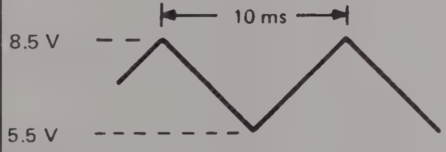
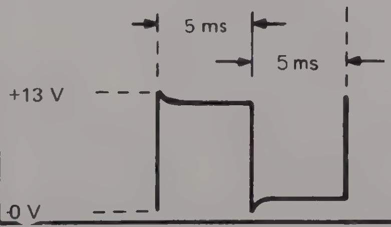
POWER SUPPLY CONTROL CARD ASSEMBLY A6A1 (PART NUMBER 601-2915-001)
LATEST EFFECTIVITY: REV K

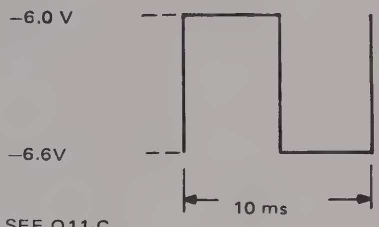
SYMBOL	DESCRIPTION	PART NUMBER
C201	Capacitor, fixed, electrolytic, 10μF, 10%, 50V	184-9087-610
C202	Capacitor, fixed, electrolytic, 22μF, 10%, 15V	184-9086-310
C203	Capacitor, fixed, mica dielectric, 1000pF, 2%, 100V	912-2093-100
C204	Capacitor, fixed, ceramic dielectric, 0.01μF, 10%, 100V	913-5019-200
C205	Capacitor, fixed, ceramic dielectric, 0.022μF, 10%, 50V	913-5019-240
C206	Capacitor, fixed, mica dielectric, 330pF, 5%, 50V	912-4141-490
C207	Capacitor, fixed, mica dielectric, 1000pF, 2%, 100V	912-2093-100
C208	Capacitor, fixed, ceramic dielectric, 0.01μF, 10%, 100V	913-5019-200
C209	Capacitor, fixed, mica dielectric, 33pF, 5%, 50V	912-4141-220
CR201	Diode, 1N4454	353-3644-010
Q201	Transistor, 2N2222A	352-0661-020
Q202	Transistor, 2N2905A	352-0550-000
Q203	Transistor, 2N2907A	352-0551-000
Q204	Transistor, 2N2222A	352-0661-020
Q205	Transistor, 2N2219A	352-0661-010
Q206	Transistor, 2N2222A	352-0661-020
R201	Resistor, fixed, film, 61.9kΩ, 1%, 1/8W	705-1082-000
R202	Resistor, fixed, film, 44.2kΩ, 1%, 1/8W	705-1075-000
R203	Resistor, fixed, film, 27.4kΩ, 1%, 1/8W	705-1065-000
R204	Resistor, fixed, film, 261kΩ, 1%, 1/8W	705-1112-000
R205	Resistor, fixed, composition, 2200Ω, 10%, 1/2W	745-1366-000
R206	Resistor, fixed, film, 46.4kΩ, 1%, 1/8W (eff to REV G)	705-1076-000
R206	Resistor, fixed, film, 45.3kΩ, 1%, 1/8W (eff REV G)	705-3605-790
R207	Resistor, fixed, film, 36.5kΩ, 1%, 1/8W	705-1071-000
R208	Resistor, fixed, composition, 47Ω, 10%, 1/4W	745-0701-000
R209	Resistor, fixed, composition, 2200Ω, 10%, 1/4W	745-0761-000
R210	Resistor, fixed, composition, 470Ω, 10%, 1/4W	745-0737-000
R211	Resistor, fixed, film, 46.4kΩ, 1%, 1/8W	705-1076-000
R212	Resistor, fixed, film, 48.7kΩ, 1%, 1/8W	705-1077-000
R212	Test selected (eff REV J)	
	Resistor, fxd, film, 45.3kΩ	705-3605-790
	Resistor, fxd, film, 46.4kΩ	705-1076-000
	Resistor, fxd, film, 47.5kΩ	705-3605-800
	Resistor, fxd, film, 48.7kΩ	705-1077-000
	Resistor, fxd, film, 49.9kΩ	705-3605-810
	Resistor, fxd, film, 51.1kΩ	705-1078-000
R213	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R214	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R215	Resistor, fixed, composition, 1000Ω, 10%, 1/4W	745-0749-000
R216	Resistor, fixed, film, 30.1kΩ, 1%, 1/8W	705-1067-000
R217	Resistor, fixed, film, 187Ω, 1%, 1/8W	705-0961-000
R218	Resistor, fixed, film, 7500Ω, 1%, 1/8W	705-1038-000
R219	Resistor, fixed, film, 2490Ω, 1%, 1/8W	705-1015-000
R220	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R221	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R222	Resistor, fixed, composition, 6800Ω, 10%, 1/4W	745-0779-000
R223	Resistor, fixed, composition, 2200Ω, 10%, 1/4W	745-0761-000
R224	Resistor, fixed, composition, 220kΩ, 10%, 1/4W	745-0833-000
U201	Integrated circuit, 555	351-1137-080
U202	Integrated circuit, 555	351-1137-080
U203	Integrated circuit, UA723	351-1035-010


POWER SUPPLY A6 (629-7148-001)
+28 V DC AIRCRAFT PWR
+28 V DC RTN
DC CHASSIS GND
GND I
L101 1.5 MH
CR101 1N5552
C115 0.02
C101 210
C102 210
C103 210
P/O P1
+27.5 V DC
+6.5 V DC
Q203 2N2907A
R217 187
R218 7500
C208 0.01
R219 2490
R214 22 K
R215 1 K
R220 10 K
C209 33pF
R221 10 K
U202 555
Q201 2N2222A
R223 2200
R222 6800
Q202 2N2905A
VR101 1N975B 39 V
CR102 1N4002
R118 22.6 K
CR106 MPD300
CR107 MPD300
+22 V DC RGLTR INPUT J2
+22 V DC RGLTR
CR103 1N5416
T101
C104 210
C105 210
Q102 2N3878
R109 0.681
L102 120UH
C116 22
+27.5 V DC
+22 V DC RGLTD
U101 UA723
R112 2150
R111 500
R110 4220
C109 47
C110 0.1
C108 4700 pF
R108 1470
C107 1
R201 61.9 K
C201 10
R202 44.2K
R213 22 K
CR201 1N4454
C207 0.001
R216 30.1 K
R204 261 K
R203 27.4 K
R205 2200
R209 2200
R210 470
Q204 2N2222A
R101 330
R102 330
Q101 U2T201
R119 100
SWITCH CURRENT J1
U203 UA723
R224 220K
Q206 2N2222A
R208 47
Q205 2N2219A
C202 22
R104 4700
R105 10 K
R103 0.1
-15 V DC RGLTR
Q103 2N2102
C106 100
CR104 1N4002
R115 4020
R116 1000
U102 UA723
R114 4.7
R117 4020
R113 2150
C112 1500pF
C111 1
R106 10 kΩ
CR105 1N4454
R207 36.5 K
R206 45.3 K
C205 0.022
C206 330pF
C204 0.01
C203 0.001
U201 555
R212 TEST SELECT
R211 46.4 K
POWER SUPPLY CONTROL CARD A6A1 (601-2915-001)
VR102 1N753A 6.2 V
R107 2200
C113 0.1
C114 47
-15 V DC RGLTD
GND I
CHASSIS GND
DH COMMON
AID COMMON
MOD PHASE COMMON
-DC ANALOG ALT
+7.15
-22.4
+5.25
-7.89
VOLTAGES ARE DC AND TAKEN WITH +28.0 V DC APPLIED
GA0-0352-064-0
637-2031

Power Supply A6 and Power Supply Control Card A6A1, Schematic Diagram
Figure 6-4

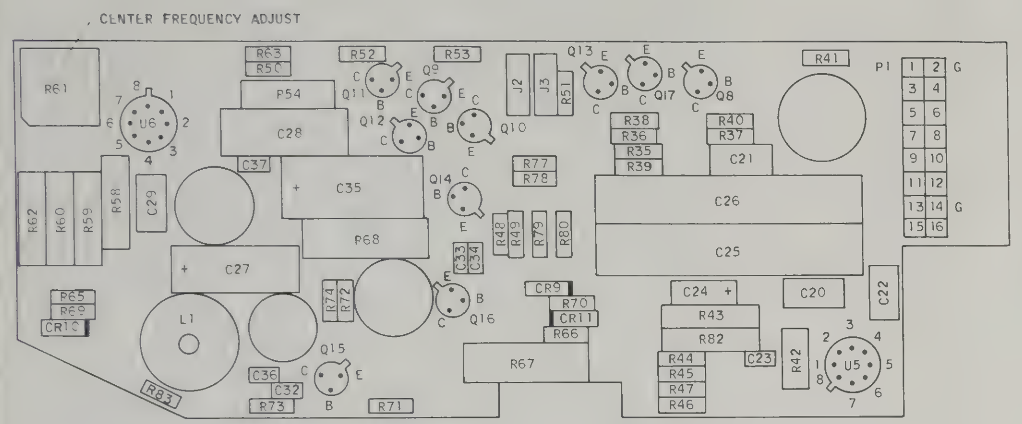
*Modulator A3 and Modulator Control A4,
Component Location Diagram
Figure 6-5*

T NT	TYPICAL WAVEFORM OR NOMINAL VOLTAGE
-ON	
	MOD A3
-B	SEE Q17-C
-C	
2	+10.92 V DC
3	+10.4 V DC
6	 +20 V +10 V 0 V 10 ms
2	+7.6 V DC
3	+7.5 V DC
6	 10 ms 8.5 V 5.5 V
-B	0 V DC
-C	 5 ms 5 ms +13 V 0 V

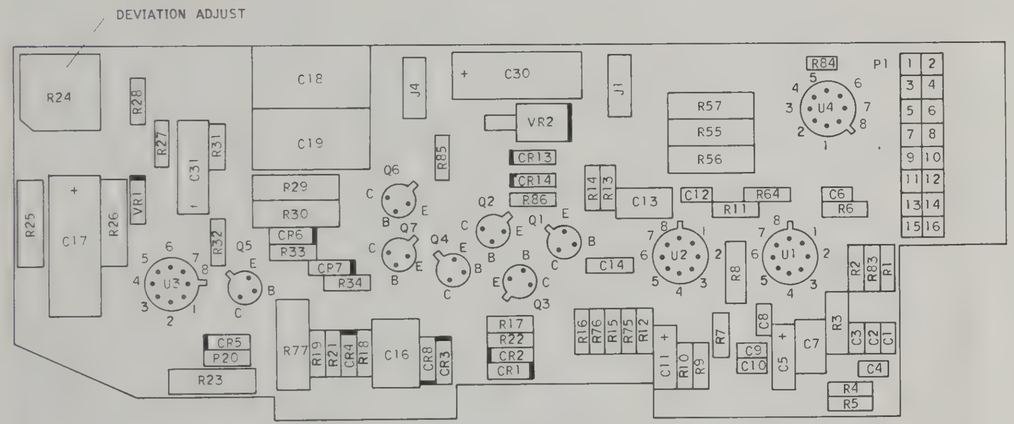
TEST POINT	TYPICAL WAVEFORM OR NOMINAL VOLTAGE
MOD A3 INSTALLED ON XMTR/MOD TEST FIXTURE INPUTS: MOD FREQ – 100 Hz DEV CONT – ON MOD PHASE – 0°	
	MOD A3
Q15E	+19.2 V DC
Q15B	+18.5 V DC
Q16E	+19.2 V DC
Q16B	+18.5 V DC
Q12-E	–6.6 V DC
Q12-B	 –6.0 V –6.6V 10 ms
Q12-C	SEE Q11-C

TP4-9253-013

Modulator A3 and Modulator Control A4, Voltages and Waveforms
Figure 6-6


CENTER FREQUENCY ADJUST
R61
U6
R63
R50
R52
R53
R54
C28
C37
C35
R68
C27
C29
R58
R59
R60
R62
R65
R69
CR12
L1
R83
C36
C32
R73
R71
Q9
Q10
Q11
Q12
Q13
Q14
Q15
Q16
Q17
Q8
J2
J3
R51
R77
R78
R48
R49
R79
R80
C33
C34
R74
R72
CR9
R70
CR11
R66
R67
R38
R36
R35
R39
R40
R37
C21
R41
C26
C25
C24
R43
R82
R44
R45
R47
R46
C23
C20
C22
R42
U5
P1
G

MODULATOR A3, COMPONENT LOCATION DIAGRAM


DEVIATION ADJUST
R24
R28
R27
C31
R31
R25
C17
R26
VR1
R32
U3
Q5
C18
C19
R29
R30
CR6
R33
CP7
R34
J4
C30
VR2
R85
CR13
CR14
R86
Q6
Q7
Q2
Q4
Q1
Q3
J1
R57
R55
R56
R84
U4
P1
R14
R13
C13
C12
R11
R64
C6
R6
C14
U2
R8
U1
R2
R83
R1
CP5
P20
R23
R77
R19
R21
CR4
R18
C16
CR8
CR3
R17
R22
CR2
CR1
R16
R76
R15
R75
R12
C11
R10
R9
R7
C9
C10
C8
C5
C7
R3
C3
C2
C1
C4
R4
R5

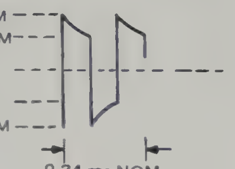
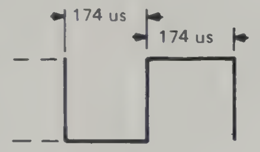
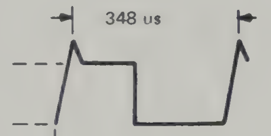
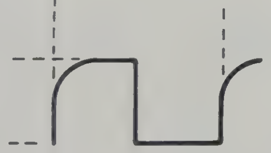
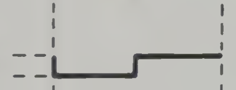
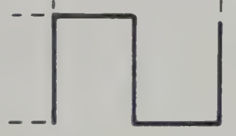
MODULATOR CONTROL A4, COMPONENT LOCATION DIAGRAM

TP4-7656-014

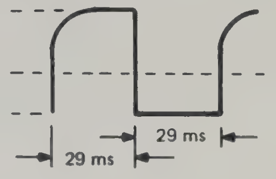
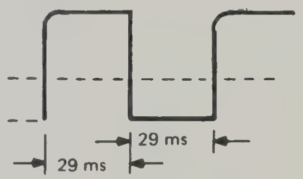
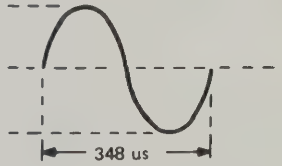
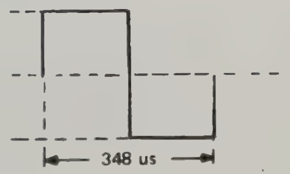
Modulator A3 and Modulator Control A4,
Component Location Diagram
Figure 6-5

MOD CONT A4/MOD A3/XMTR A5 ASSY INSTALLED ON XMTR/MOD TEST FIXTURE
INPUTS: MOD PHASE 0° A4J4 GROUNDED
MOD FREQ 100 Hz

MOD CONT A4

TEST POINT	TYPICAL WAVEFORM OR NOMINAL VOLTAGE
	NOTE: WAVEFORMS MAY BE SLIGHTLY IRREGULAR AT TURN AROUND POINTS
Q1-B	+12V NOM +1.5V NOM –5V NOM –10V NOM  0.34 ms NOM
Q1-E	+0.62 V DC
Q2-B	–0.14 V DC
Q2-C	+21.55 V DC
Q3-C	174 us 174 us +22.0 V 0.0 V 
Q4-B	348 us –14.4V –15.0V 
Q4-C	0.0 V –14.0 V 
Q5-B	–13.0 V –14 0 V 
Q5-C	0.0 V –15.0 V 
Q6-B	–14.61 V DC
Q6-E	–14.99 V DC

MOD CONT A4

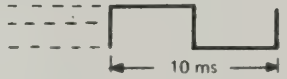
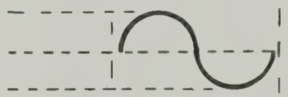
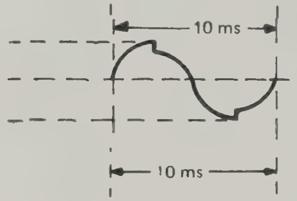
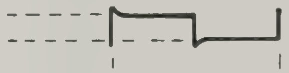
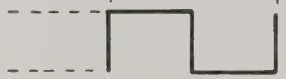
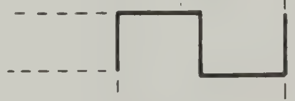
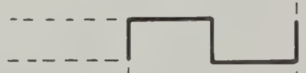
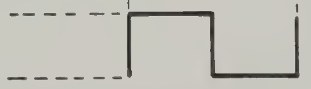
TEST POINT	TYPICAL WAVEFORM OR NOMINAL VOLTAGE
Q6-C	+15.0 V 0.0 V –14.0 V  29 ms 29 ms
Q7-B	–14.6 V DC
Q7-C	+15.0 V 0.0 V –14.0 V  29 ms 29 ms
U1-2	+10.96 V DC
U1-3	+10.96 V DC
U1-6	+11.5V +11V +10.5V  348 us
U2-2	+10.86 V DC
U2-3	+10.86 V DC
U2-6	+12V –10V  348 us

MOD CONT A4

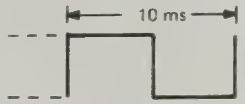
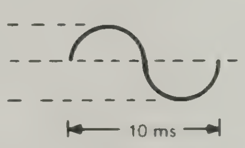
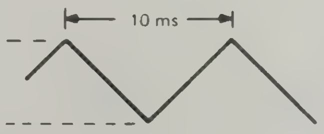
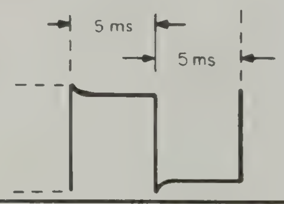
TEST POINT	TYPICAL WAVEFORM OR NOMINAL VOLTAGE
U3-2	+0.0524 V DC
U3-3	+0.0511 V DC
U3-6	+5.87 V DC
U4-2	+0.0518 V DC
U4-3	+0.0512 V DC
U4-6	–5.789 V DC

MOD A3 INSTALLED ON XMTR/MOD TEST FIXTURE
INPUTS: MOD FREQ – 100 Hz DEV CONT–ON
MOD PHASE – 0°

MOD A3

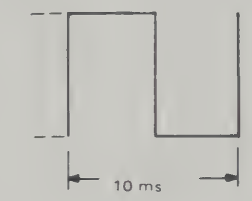
TEST POINT	TYPICAL WAVEFORM OR NOMINAL VOLTAGE
Q8-E	+1.8 V DC
Q17-B	0 V DC
Q17-C *	+350 mV +20 V –350 mV  10 ms
Q8-B	+6 V 0 V –6 V 
Q8-C *	10 ms +360 mV 0 mV –360 mV  10 ms
Q9-B	+0.6 V –0.6 V 
Q9-C	+6 V 0 V 
Q10-B	SEE Q9-B
Q10-C	0 V –6 V 
Q11-E	+6.6 VDC
Q11-B	+6.6V +6.0 V 
Q11-C	+6V –6 V 

MOD A3

TEST POINT	TYPICAL WAVEFORM OR NOMINAL VOLTAGE
Q13-B	SEE Q17-C
Q13-C	10 ms +24 V 0 V 
U5-2	+10 92 V DC
U5-3	+10.4 V DC
U5-6	+20 V +10 V 0 V  10 ms
U6-2	+7.6 V DC
U6-3	+7.5 V DC
U6-6	10 ms 8.5 V 5.5 V 
Q14-B	0 V DC
Q14-C	5 ms 5 ms +13 V 0 V 

MOD A3 INSTALLED ON XMTR MOD TEST FIXTURE
INPUTS: MOD FREQ – 100 Hz DEV CONT – ON
MOD PHASE – 0°

MOD A3

TEST POINT	TYPICAL WAVEFORM OR NOMINAL VOLTAGE
Q15E	+19.2 V DC
Q15B	+18.5 V DC
Q16E	+19.2 V DC
Q16B	+18.5 V DC
Q12-E	–6.6 V DC
Q12-B	–6.0 V –6.6V  10 ms
Q12-C	SEE Q11-C

* WAVEFORM SHOWN IS WITH SCOPE AC COUPLED

TP4-9253-013

Modulator A3 and Modulator Control A4, Voltages and Waveforms
Figure 6-6

SCHEMATIC CHANGES

REVISION IDENTIFICATION	DESCRIPTION OF REVISION AND REASON FOR CHANGE	SERVICE BULLETIN	EFFECTIVITY
	The following schematic corrections apply to all units.		
None	Changed A3C25, C26 from 5.5 μF to 5.0 μF; changed A4R30 from 38.2 kΩ to 38.3 kΩ; +21.5 V dc input added at A3P1-11; changed input voltage at A3U6-7 and A3R60 from +22 V dc to +21.5 V dc; added A3P1-14; changed A3P1-2 from chassis gnd to xmtr ref sig shld; added A4P1-1, -3, -5, -6, -9, and -10.	None	All units

P/O Modulator A3 and Modulator Control A4, Schematic Diagram
Figure 6-7 (Sheet A)

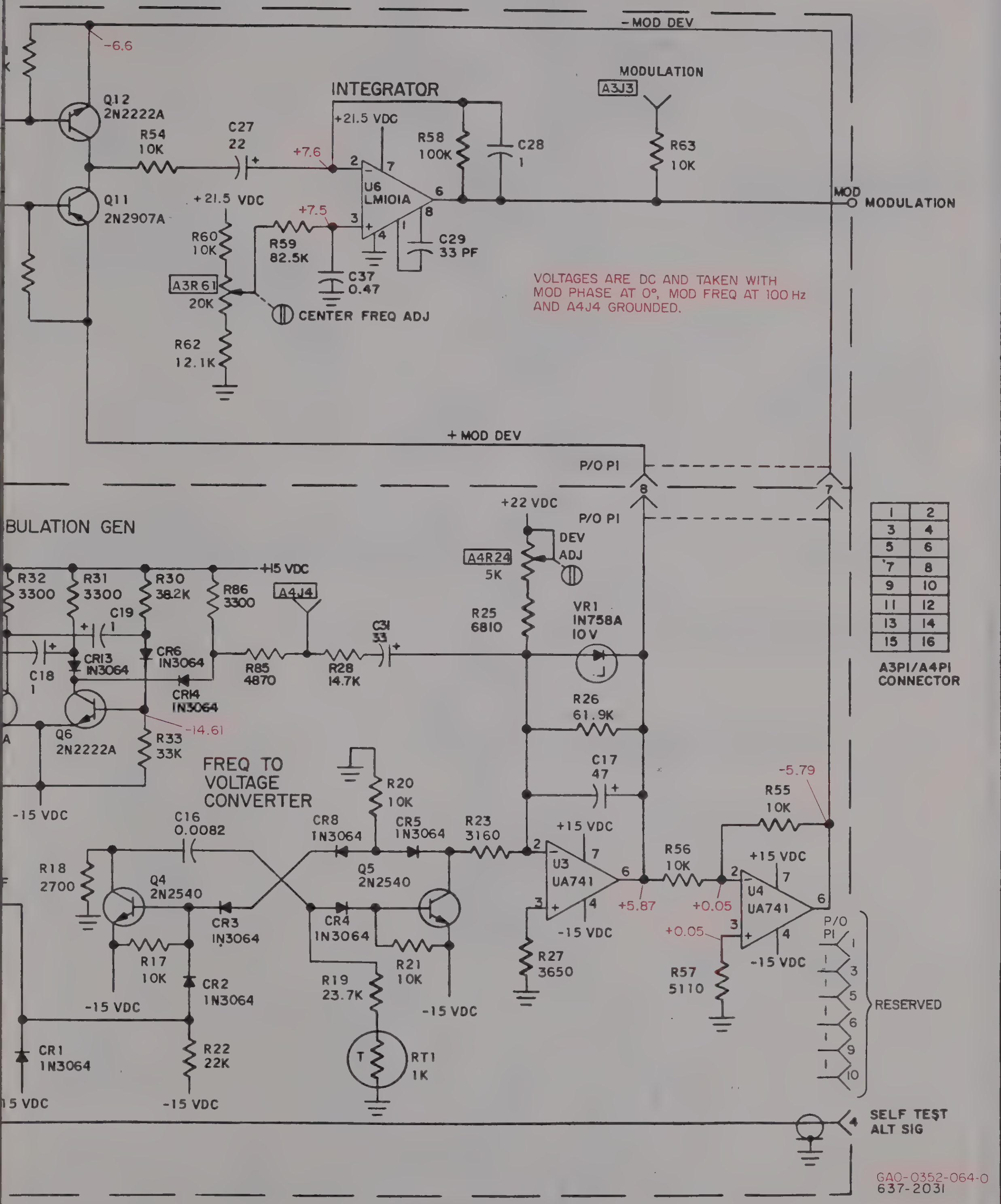
PARTS LIST
MODULATOR CIRCUIT CARD ASSEMBLY A3 (PART NUMBER 617-9311-001)
LATEST EFFECTIVITY: REV AC

SYMBOL	DESCRIPTION	PART NUMBER
C1-C19	Not used	
C20	Capacitor, fixed, plastic dielectric, 0.1μF, 2%, 50V	933-1075-310
C21	Capacitor, fixed, plastic dielectric, 0.1μF, 2%, 50V	933-1075-310
C22	Capacitor, fixed, mica dielectric, 20pF, 5%, 500V	912-3841-000
C23	Capacitor, fixed, ceramic dielectric 560pF, 10%, 200V	913-4015-000
C24	Capacitor, fixed, electrolytic, 1μF, 20%, 35V	184-7398-000
C25	Capacitor, fixed, electrolytic, 5μF, 20%, 35V	184-8270-000
C26	Capacitor, fixed, electrolytic, 5μF, 20%, 35V	184-8270-000
C27	Capacitor, fixed, electrolytic, 22μF, 20%, 35V (eff to REV U)	184-9083-670
C27	Capacitor, fixed, electrolytic, 22μF, 20%, 35V (eff REV U)	184-9087-670
C28	Capacitor, fixed, plastic dielectric, 1μF, 10%, 50V	933-1081-200
C29	Capacitor, fixed, mica dielectric 33pF, 5%, 500V	912-3848-000
C30-C31	Not used	
C32	Capacitor, fixed, ceramic dielectric, 0.01μF, 10%, 100V	913-5019-200
C33	Capacitor, fixed, ceramic dielectric, 0.01μF, 10%, 100V	913-5019-200
C34	Capacitor, fixed, ceramic dielectric, 0.01μF, 10%, 100V	913-5019-200
C35	Capacitor, fixed, electrolytic, 47μF, 10%, 35V (eff to REV AA)	184-9083-720
C35	Capacitor, fixed, electrolytic, 47μF, 10%, 35V (eff REV AA)	184-9086-720
C36	Capacitor, fixed, ceramic dielectric 0.01μF, 10%, 50V	913-5019-200
C37	Capacitor, fixed, ceramic dielectric 0.47μF, 10%, 50V	913-5019-520
CR1-CR8	Not used	
CR9	Diode, 1N3064	353-3404-000
CR10	Diode, 1N3064	353-3404-000
CR11	Diode, 1N3064	353-3404-000
J1	Not used	
J2	Jack	360-0437-010
J3	Jack	360-0437-010
L1	Coil, 1.25MH	668-0252-010
P1	Connector, electrical	372-2330-170
Q1-Q7	Not used	
Q8	Transistor, 2N2222A	352-0661-020
Q9	Transistor, 2N2222A	352-0661-020
Q10	Transistor, 2N2907A	352-0551-010
Q11	Transistor, 2N2907A	352-0551-010
Q12	Transistor, 2N2222A	352-0661-020
Q13	Transistor, 2N2907A	352-0551-010
Q14	Transistor, 2N2222A	352-0661-020
Q15	Transistor, 2N2907A	352-0551-010
Q16	Transistor, 2N2907A	352-0551-010
Q17	Transistor, 2N2222A	352-0661-020
R1-R34	Not used	
R35	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R36	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R37	Resistor, fixed, film, 649Ω, 1%, 1/8W (eff to REV AA)	705-6031-170
R37	Resistor, fixed, film, 649Ω, 1%, 1/8W (eff REV AA)	705-0987-000
R38	Resistor, fixed, film, 536Ω, 1%, 1/8W (eff to REV AA)	705-6031-010
R38	Resistor, fixed, film, 536Ω, 1%, 1/8W (eff REV AA)	705-0983-000
R39	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R40	Resistor, fixed, composition, 82kΩ, 10%, 1/4W	745-0818-000
	Test select resistor kit	618-2439-001
R41	Resistor, fixed, film, 505Ω, 1%, 1/8W	705-6030-950
R41	Resistor, fixed, film, 511Ω, 1%, 1/8W	705-6030-960
R41	Resistor, fixed, film, 517Ω, 1%, 1/8W	705-6030-970
R41	Resistor, fixed, film, 523Ω, 1%, 1/8W	705-6030-980
R41	Resistor, fixed, film, 530Ω, 1%, 1/8W	705-6030-990
R41	Resistor, fixed, film, 536Ω, 1%, 1/8W	705-6031-010
R41	Resistor, fixed, film, 542Ω, 1%, 1/8W	705-6031-020
R41	Resistor, fixed, film, 549Ω, 1%, 1/8W	705-6031-030
R41	Resistor, fixed, film, 556Ω, 1%, 1/8W	705-6031-040
R41	Resistor, fixed, film, 562Ω, 1%, 1/8W	705-6031-050
R41	Resistor, fixed, film, 569Ω, 1%, 1/8W	705-6031-060
R42	Resistor, fixed, film, 215kΩ, 1%, 1/8W (eff to REV AA)	705-6036-060
R42	Resistor, fixed, film, 215kΩ, 1%, 1/8W (eff REV AA)	705-1108-000
R43	Resistor, fixed, film, 750kΩ, 1%, 1/4W	705-6734-000
R44	Resistor, fixed, composition, 1500Ω, 10%, 1/4W	745-0755-000
R45	Resistor, fixed, composition, 3300Ω, 10%, 1/4W	745-0767-000
R46	Resistor, fixed, composition, 1kΩ, 10%, 1/4W	745-0749-000
R47	Resistor, fixed, composition, 1kΩ, 10%, 1/4W	745-0749-000
R48	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R49	Resistor, fixed, composition, 56kΩ, 10%, 1/4W	745-0812-000
R50	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R51	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R52	Resistor, fixed, composition, 15kΩ, 10%, 1/4W	745-0791-000
R53	Resistor, fixed, composition, 15kΩ, 10%, 1/4W	745-0791-000
R54	Resistor, fixed, film, 10kΩ, 1%, 1/8W	705-6297-000
R55-R57	Not used	
R58	Resistor, fixed, film, 100kΩ, 1%, 1/8W	705-6321-000
R59	Resistor, fixed, film, 82.5kΩ, 1%, 1/8W	705-6319-000
R60	Resistor, fixed, film, 10kΩ, 1%, 1/8W	705-6297-000
R61	Resistor, variable, 20kΩ, 5%, 3/4W	381-1721-160
R62	Resistor, fixed, film, 12.1kΩ, 1%, 1/8W	705-6299-000
R63	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R64	Not used	
R65	Resistor, fixed, film, 562Ω, 1%, 1/8W	705-1454-330
R66	Resistor, fixed, film, 562Ω, 1%, 1/8W	705-1454-330
R67	Resistor, fixed, film, 21.5Ω, 1%, 1/2W	705-7016-000
R68	Resistor, fixed, film, 21.5Ω, 1%, 1/8W	705-7016-000
R69	Resistor, fixed, film, 3480Ω, 1%, 1/8W	705-1454-520
R70	Resistor, fixed, film, 3480Ω, 1%, 1/8W	705-1454-520
R71	Resistor, fixed, composition, 47Ω, 10%, 1/4W	745-0701-000
R72	Resistor, fixed, composition, 47Ω, 10%, 1/4W	745-0701-000
R73	Resistor, fixed, composition, 1kΩ, 10%, 1/4W	745-0749-000
R74	Resistor, fixed, composition, 1kΩ, 10%, 1/4W	745-0749-000
R75-R76	Not used	
R77	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R78	Resistor, fixed, composition, 12kΩ, 10%, 1/4W	745-0788-000
R79	Resistor, fixed, composition, 47kΩ, 10%, 1/4W	745-0809-000
R80	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R81	Not used	
R82	Resistor, fixed, film, 750kΩ, 1%, 1/4W	705-6734-000
R83	Resistor, fixed, composition, 1kΩ, 10%, 1/8W	745-2341-000
U1-U4	Not used	
U5	Integrated circuit, UA709	351-7141-010
U6	Integrated circuit, LM101A	351-1040-020

MODULATOR CONTROL CIRCUIT CARD ASSEMBLY A4 (PART NUMBER 617-9313-001)
LATEST EFFECTIVITY: REV U

SYMBOL	DESCRIPTION	PART NUMBER
C1	Capacitor, fixed, ceramic dielectric, 0.1μF, 10%, 100V	913-5019-440
C2	Capacitor, fixed, ceramic dielectric, 0.022μF, 10%, 50V	913-5019-240
C3	Capacitor, fixed, ceramic dielectric, 0.022μF, 10%, 50V	913-5019-240
C4	Capacitor, fixed, ceramic dielectric, 470pF, 10%, 200V	913-4014-000
C5	Capacitor, fixed, electrolytic, 1μF, 20%, 35V	184-7398-000
C6	Capacitor, fixed, ceramic dielectric, 560pF, 10%, 200V	913-4015-000
C7	Capacitor, fixed, mica dielectric, 20pF, 5%, 500V	912-3841-000
C8	Capacitor, fixed, ceramic dielectric, 0.022μF, 10%, 50V	913-5019-240
C9	Capacitor, fixed, ceramic dielectric, 0.022μF, 10%, 50V	913-5019-240
C10	Capacitor, fixed, ceramic dielectric, 470pF, 10%, 200V	913-4014-000
C11	Capacitor, fixed, electrolytic, 1μF, 20%, 35V	184-7398-000
C12	Capacitor, fixed, ceramic dielectric, 560pF, 10%, 200V	913-4015-000
C13	Capacitor, fixed, mica dielectric, 20pF, 5%, 500V	912-3841-000
C14	Capacitor, fixed, ceramic dielectric, 4700pF, 10%, 200V	913-4026-000
C15	Capacitor, fixed, ceramic dielectric, 330pF, 10%, 200V	913-4012-000
C16	Capacitor, fixed, ceramic dielectric, 8200pF, 5%, 100V	913-3281-400
C17	Capacitor, fixed, electrolytic, 47μF, 20%, 35V (eff to REV U)	184-9083-730
C17	Capacitor, fixed, electrolytic, 47μF, 20%, 35V (eff REV U)	184-9086-730
C18	Capacitor, fixed, plastic dielectric, 1μF, 2%, 50V	933-0264-250
C19	Capacitor, fixed, plastic dielectric, 1μF, 2%, 50V	933-0264-250
C20-C29	Not used	
C30	Capacitor, fixed, electrolytic, 10μF, 10%, 50V (eff to REV U)	184-9084-610
C30	Capacitor, fixed, electrolytic, 10μF, 10%, 50V (eff REV U)	184-9087-610
C31	Capacitor, fixed, electrolytic, 33μF, 20%, 10V	184-7382-000
CR1	Diode, 1N3064	353-3404-000
CR2	Diode, 1N3064	353-3404-000
CR3	Diode, 1N3064	353-3404-000
CR4	Diode, 1N3064	353-3404-000
CR5	Diode, 1N3064	353-3404-000
CR6	Diode, 1N3064	353-3404-000
CR7	Diode, 1N3064	353-3404-000
CR8	Diode, 1N3064	353-3404-000
CR9-CR12	Not used	
CR13	Diode, 1N3064	353-3404-000
CR14	Diode, 1N3064	353-3404-000
J1	Jack	360-0437-010
J2-J3	Not used	
J4	Jack	360-0437-010
Q1	Transistor, 2N2222A	352-0661-020
Q2	Transistor, 2N2222A	352-0661-020
Q3	Transistor, 2N2907A	352-0551-010
Q4	Transistor, 2N2540	352-0509-000
Q5	Transistor, 2N2540	352-0509-000
Q6	Transistor, 2N2222A	352-0661-020
Q7	Transistor, 2N2222A	352-0661-020
R1	Resistor, fixed, composition, 470Ω, 10%, 1/4W	745-0737-000
R2	Resistor, fixed, film, 2740Ω, 1%, 1/8W	705-1470-720
R3	Resistor, fixed, film, 232kΩ, 1%, 1/8W	705-3604-180
R4	Resistor, fixed, composition, 470kΩ, 10%, 1/4W	745-0845-000
R5	Resistor, fixed, composition, 470kΩ, 10%, 1/4W	745-0845-000
R6	Resistor, fixed, composition, 1500Ω, 10%, 1/4W	745-0755-000
R7	Resistor, fixed, film, 2740Ω, 1%, 1/8W	705-1470-720
R8	Resistor, fixed, film, 232kΩ, 1%, 1/8W	705-3604-180
R9	Resistor, fixed, composition, 470kΩ, 10%, 1/4W	745-0845-000
R10	Resistor, fixed, composition, 470kΩ, 10%, 1/4W	745-0845-000
R11	Resistor, fixed, composition, 1500Ω, 10%, 1/4W	745-0755-000
R12	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R13	Resistor, fixed, composition, 33kΩ, 10%, 1/4W	745-0803-000
R14	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R15	Resistor, fixed, composition, 15kΩ, 10%, 1/4W	745-0791-000
R16	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R17	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R18	Resistor, fixed, composition, 2700Ω, 10%, 1/4W	745-0764-000
R19	Resistor, fixed, film, 23.7kΩ, 0.1%, 1/10W	705-5976-200
R20	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R21	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R22	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R23	Resistor, fixed, film, 3160Ω, 1%, 1/8W	705-6285-000
R24	Resistor, variable, wire-wound, 5kΩ, 5%, 3/4W	381-1721-120
R25	Resistor, fixed, film, 6810Ω, 1%, 1/8W	705-6293-000
R26	Resistor, fixed, film, 61.9kΩ, 1%, 1/8W	705-6316-000

SYM
R27
R28
R29
R30
R31
R32
R33
R34
R35
R54
R55
R56
R57
R58
R63
R64
R65
R74
R75
R76
R77
R82
R83
R84
R85
R86
RT1
U1
U2
U3
U4
VR1
VR2



-MOD DEV
-6.6
MODULATION
A3J3
INTEGRATOR
Q12 2N2222A
R54 10K
C27 22
+7.6
+21.5 VDC
R58 100K
C28 1
R63 10K
U6 LM101A
Q11 2N2907A
+21.5 VDC
+7.5
MOD
MODULATION
R60 10K
R59 82.5K
C29 33 PF
C37 0.47
A3R61 20K
CENTER FREQ ADJ
VOLTAGES ARE DC AND TAKEN WITH MOD PHASE AT 0°, MOD FREQ AT 100 Hz AND A4J4 GROUNDED.
R62 12.1K
+MOD DEV
P/O P1
+22 VDC
P/O P1
BULATION GEN
DEV ADJ
A4R24 5K
+15 VDC
R32 3300
R31 3300
R30 38.2K
R86 3300
A4J4
C19 1
R25 6810
VR1 1N758A 10V
C31 33
C18 1
CR13 1N3064
CR6 1N3064
R85 4870
R28 14.7K
CR14 1N3064
R26 61.9K
Q6 2N2222A
-14.61
R33 33K
FREQ TO VOLTAGE CONVERTER
C17 47
-5.79
R20 10K
R55 10K
-15 VDC
C16 0.0082
CR8 1N3064
CR5 1N3064
R23 3160
+15 VDC
R18 2700
Q4 2N2540
Q5 2N2540
U3 UA741
R56 10K
+15 VDC
U4 UA741
CR3 1N3064
CR4 1N3064
+5.87
+0.05
+0.05
-15 VDC
R17 10K
CR2 1N3064
R21 10K
R19 23.7K
R27 3650
R57 5110
-15 VDC
-15 VDC
-15 VDC
P/O P1
RESERVED
CR1 1N3064
R22 22K
RT1 1K
15 VDC
-15 VDC
SELF TEST ALT SIG
A3P1/A4P1 CONNECTOR
GA0-0352-064-0
637-2031

1	2
3	4
5	6
7	8
9	10
11	12
13	14
15	16

P/O Modulator A3 and Modulator Control A4, Schematic Diagram
Figure 6-7

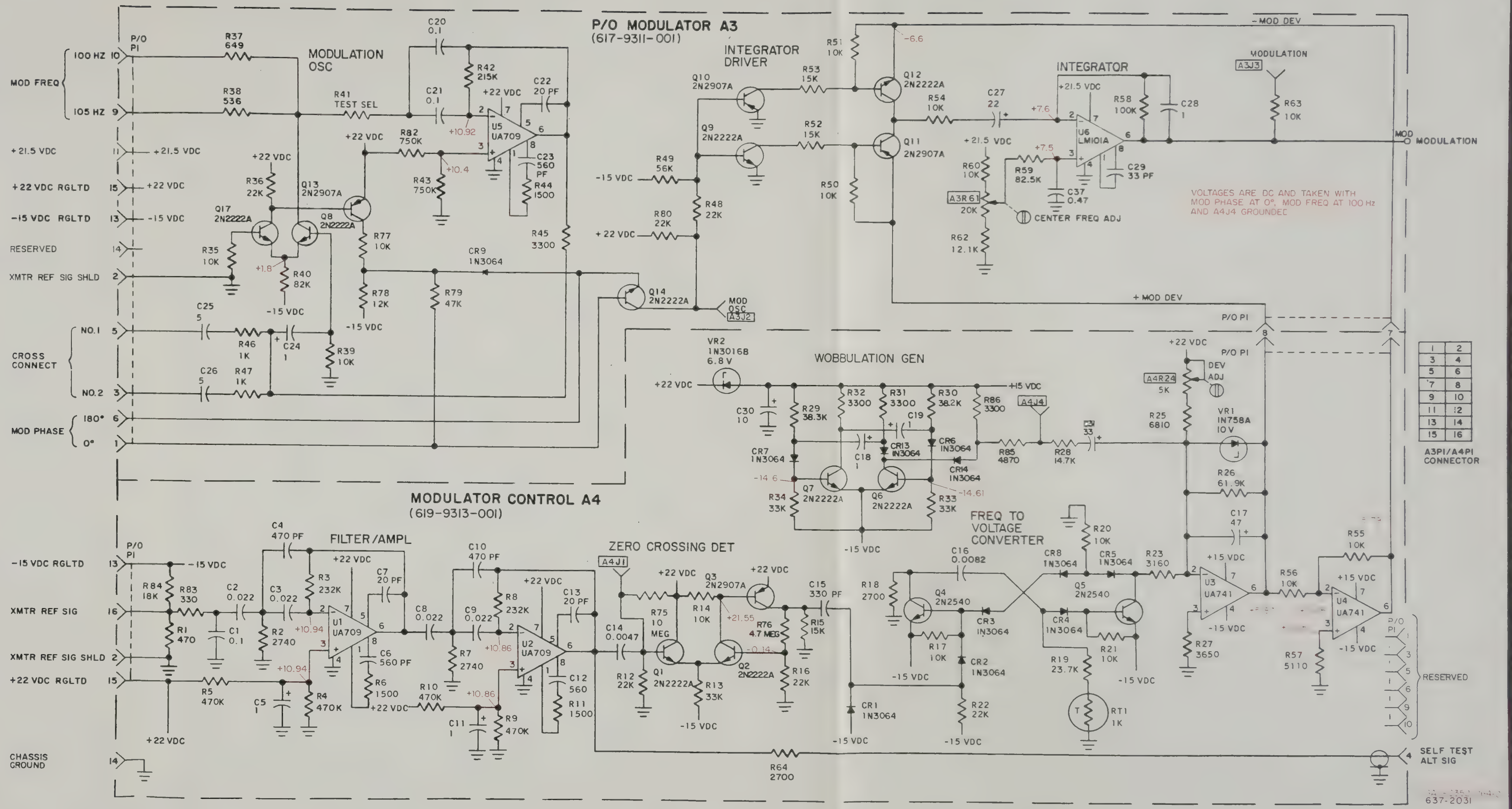
PARTS LIST
MODULATOR CIRCUIT CARD ASSEMBLY A3 (PART NUMBER 617-9311-001)
LATEST EFFECTIVITY: REV AC

SYMBOL	DESCRIPTION	PART NUMBER
C1-C19	Not used	
C20	Capacitor, fixed, plastic dielectric, 0.1µF, 2%, 50V	933-1075-310
C21	Capacitor, fixed, plastic dielectric, 0.1µF, 2%, 50V	933-1075-310
C22	Capacitor, fixed, mica dielectric, 20pF, 5%, 500V	912-3841-000
C23	Capacitor, fixed, ceramic dielectric 560pF, 10%, 200V	913-4015-000
C24	Capacitor, fixed, electrolytic, 1µF, 20%, 35V	184-7398-000
C25	Capacitor, fixed, electrolytic, 5µF, 20%, 35V	184-8270-000
C26	Capacitor, fixed, electrolytic, 5µF, 20%, 35V	184-8270-000
C27	Capacitor, fixed, electrolytic, 22µF, 20%, 35V (eff to REV U)	184-9083-670
C27	Capacitor, fixed, electrolytic, 22µF, 20%, 35V (eff REV U)	184-9087-670
C28	Capacitor, fixed, plastic dielectric, 1µF, 10%, 50V	933-1081-200
C29	Capacitor, fixed, mica dielectric 33pF, 5%, 500V	912-3848-000
C30-C31	Not used	
C32	Capacitor, fixed, ceramic dielectric, 0.01µF, 10%, 100V	913-5019-200
C33	Capacitor, fixed, ceramic dielectric, 0.01µF, 10%, 100V	913-5019-200
C34	Capacitor, fixed, ceramic dielectric, 0.01µF, 10%, 100V	913-5019-200
C35	Capacitor, fixed, electrolytic, 47µF, 10%, 35V (eff to REV AA)	184-9083-720
C35	Capacitor, fixed, electrolytic, 47µF, 10%, 35V (eff REV AA)	184-9086-720
C36	Capacitor, fixed, ceramic dielectric 0.01µF, 10%, 50V	913-5019-200
C37	Capacitor, fixed, ceramic dielectric 0.47µF, 10%, 50V	913-5019-520
CR1-CR8	Not used	
CR9	Diode, 1N3064	353-3404-000
CR10	Diode, 1N3064	353-3404-000
CR11	Diode, 1N3064	353-3404-000
J1	Not used	
J2	Jack	360-0437-010
J3	Jack	360-0437-010
L1	Coil, 1.25MH	668-0252-010
P1	Connector, electrical	372-2330-170
Q1-Q7	Not used	
Q8	Transistor, 2N2222A	352-0661-020
Q9	Transistor, 2N2222A	352-0661-020
Q10	Transistor, 2N2907A	352-0551-010
Q11	Transistor, 2N2907A	352-0551-010
Q12	Transistor, 2N2222A	352-0661-020
Q13	Transistor, 2N2907A	352-0551-010
Q14	Transistor, 2N2222A	352-0661-020
Q15	Transistor, 2N2907A	352-0551-010
Q16	Transistor, 2N2907A	352-0551-010
Q17	Transistor, 2N2222A	352-0661-020
R1-R34	Not used	
R35	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R36	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R37	Resistor, fixed, film, 649Ω, 1%, 1/8W (eff to REV AA)	705-6031-170
R37	Resistor, fixed, film, 649Ω, 1%, 1/8W (eff REV AA)	705-0987-000
R38	Resistor, fixed, film, 536Ω, 1%, 1/8W (eff to REV AA)	705-6031-010
R38	Resistor, fixed, film, 536Ω, 1%, 1/8W (eff REV AA)	705-0983-000
R39	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R40	Resistor, fixed, composition, 82kΩ, 10%, 1/4W	745-0818-000
	Test select resistor kit	618-2439-001
R41	Resistor, fixed, film, 505Ω, 1%, 1/8W	705-6030-950
R41	Resistor, fixed, film, 511Ω, 1%, 1/8W	705-6030-960
R41	Resistor, fixed, film, 517Ω, 1%, 1/8W	705-6030-970
R41	Resistor, fixed, film, 523Ω, 1%, 1/8W	705-6030-980
R41	Resistor, fixed, film, 530Ω, 1%, 1/8W	705-6030-990
R41	Resistor, fixed, film, 536Ω, 1%, 1/8W	705-6031-010
R41	Resistor, fixed, film, 542Ω, 1%, 1/8W	705-6031-020
R41	Resistor, fixed, film, 549Ω, 1%, 1/8W	705-6031-030
R41	Resistor, fixed, film, 556Ω, 1%, 1/8W	705-6031-040
R41	Resistor, fixed, film, 562Ω, 1%, 1/8W	705-6031-050
R41	Resistor, fixed, film, 569Ω, 1%, 1/8W	705-6031-060
R42	Resistor, fixed, film, 215kΩ, 1%, 1/8W (eff to REV AA)	705-6036-060
R42	Resistor, fixed, film, 215kΩ, 1%, 1/8W (eff REV AA)	705-1108-000
R43	Resistor, fixed, film, 750kΩ, 1%, 1/4W	705-6734-000
R44	Resistor, fixed, composition, 1500Ω, 10%, 1/4W	745-0755-000
R45	Resistor, fixed, composition, 3300Ω, 10%, 1/4W	745-0767-000
R46	Resistor, fixed, composition, 1kΩ, 10%, 1/4W	745-0749-000
R47	Resistor, fixed, composition, 1kΩ, 10%, 1/4W	745-0749-000
R48	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R49	Resistor, fixed, composition, 56kΩ, 10%, 1/4W	745-0812-000
R50	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R51	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R52	Resistor, fixed, composition, 15kΩ, 10%, 1/4W	745-0791-000
R53	Resistor, fixed, composition, 15kΩ, 10%, 1/4W	745-0791-000
R54	Resistor, fixed, film, 10kΩ, 1%, 1/8W	705-6297-000
R55-R57	Not used	
R58	Resistor, fixed, film, 100kΩ, 1%, 1/8W	705-6321-000
R59	Resistor, fixed, film, 82.5kΩ, 1%, 1/8W	705-6319-000
R60	Resistor, fixed, film, 10kΩ, 1%, 1/8W	705-6297-000
R61	Resistor, variable, 20kΩ, 5%, 3/4W	381-1721-160
R62	Resistor, fixed, film, 12.1kΩ, 1%, 1/8W	705-6299-000
R63	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R64	Not used	
R65	Resistor, fixed, film, 562Ω, 1%, 1/8W	705-1454-330
R66	Resistor, fixed, film, 562Ω, 1%, 1/8W	705-1454-330
R67	Resistor, fixed, film, 21.5Ω, 1%, 1/2W	705-7016-000
R68	Resistor, fixed, film, 21.5Ω, 1%, 1/8W	705-7016-000
R69	Resistor, fixed, film, 3480Ω, 1%, 1/8W	705-1454-520
R70	Resistor, fixed, film, 3480Ω, 1%, 1/8W	705-1454-520
R71	Resistor, fixed, composition, 47Ω, 10%, 1/4W	745-0701-000
R72	Resistor, fixed, composition, 47Ω, 10%, 1/4W	745-0701-000
R73	Resistor, fixed, composition, 1kΩ, 10%, 1/4W	745-0749-000
R74	Resistor, fixed, composition, 1kΩ, 10%, 1/4W	745-0749-000
R75-R76	Not used	
R77	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R78	Resistor, fixed, composition, 12kΩ, 10%, 1/4W	745-0788-000
R79	Resistor, fixed, composition, 47kΩ, 10%, 1/4W	745-0809-000
R80	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R81	Not used	
R82	Resistor, fixed, film, 750kΩ, 1%, 1/4W	705-6734-000
R83	Resistor, fixed, composition, 1kΩ, 10%, 1/8W	745-2341-000
U1-U4	Not used	
U5	Integrated circuit, UA709	351-7141-010
U6	Integrated circuit, LM101A	351-1040-020

MODULATOR CONTROL CIRCUIT CARD ASSEMBLY A4 (PART NUMBER 617-9313-001)
LATEST EFFECTIVITY: REV U

SYMBOL	DESCRIPTION	PART NUMBER
C1	Capacitor, fixed, ceramic dielectric, 0.1µF, 10%, 100V	913-5019-440
C2	Capacitor, fixed, ceramic dielectric, 0.022µF, 10%, 50V	913-5019-240
C3	Capacitor, fixed, ceramic dielectric, 0.022µF, 10%, 50V	913-5019-240
C4	Capacitor, fixed, ceramic dielectric, 470pF, 10%, 200V	913-4014-000
C5	Capacitor, fixed, electrolytic, 1µF, 20%, 35V	184-7398-000
C6	Capacitor, fixed, ceramic dielectric, 560pF, 10%, 200V	913-4015-000
C7	Capacitor, fixed, mica dielectric, 20pF, 5%, 500V	912-3841-000
C8	Capacitor, fixed, ceramic dielectric, 0.022µF, 10%, 50V	913-5019-240
C9	Capacitor, fixed, ceramic dielectric, 0.022µF, 10%, 50V	913-5019-240
C10	Capacitor, fixed, ceramic dielectric, 470pF, 10%, 200V	913-4014-000
C11	Capacitor, fixed, electrolytic, 1µF, 20%, 35V	184-7398-000
C12	Capacitor, fixed, ceramic dielectric, 560pF, 10%, 200V	913-4015-000
C13	Capacitor, fixed, mica dielectric, 20pF, 5%, 500V	912-3841-000
C14	Capacitor, fixed, ceramic dielectric, 4700pF, 10%, 200V	913-4026-000
C15	Capacitor, fixed, ceramic dielectric, 330pF, 10%, 200V	913-4012-000
C16	Capacitor, fixed, ceramic dielectric, 8200pF, 5%, 100V	913-3281-400
C17	Capacitor, fixed, electrolytic, 47µF, 20%, 35V (eff to REV U)	184-9083-730
C17	Capacitor, fixed, electrolytic, 47µF, 20%, 35V (eff REV U)	184-9086-730
C18	Capacitor, fixed, plastic dielectric, 1µF, 2%, 50V	933-0264-250
C19	Capacitor, fixed, plastic dielectric, 1µF, 2%, 50V	933-0264-250
C20-C29	Not used	
C30	Capacitor, fixed, electrolytic, 10µF, 10%, 50V (eff to REV U)	184-9084-610
C30	Capacitor, fixed, electrolytic, 10µF, 10%, 50V (eff REV U)	184-9087-610
C31	Capacitor, fixed, electrolytic, 33µF, 20%, 10V	184-7382-000
CR1	Diode, 1N3064	353-3404-000
CR2	Diode, 1N3064	353-3404-000
CR3	Diode, 1N3064	353-3404-000
CR4	Diode, 1N3064	353-3404-000
CR5	Diode, 1N3064	353-3404-000
CR6	Diode, 1N3064	353-3404-000
CR7	Diode, 1N3064	353-3404-000
CR8	Diode, 1N3064	353-3404-000
CR9-CR12	Not used	
CR13	Diode, 1N3064	353-3404-000
CR14	Diode, 1N3064	353-3404-000
J1	Jack	360-0437-010
J2-J3	Not used	
J4	Jack	360-0437-010
Q1	Transistor, 2N2222A	352-0661-020
Q2	Transistor, 2N2222A	352-0661-020
Q3	Transistor, 2N2907A	352-0551-010
Q4	Transistor, 2N2540	352-0509-000
Q5	Transistor, 2N2540	352-0509-000
Q6	Transistor, 2N2222A	352-0661-020
Q7	Transistor, 2N2222A	352-0661-020
R1	Resistor, fixed, composition, 470Ω, 10%, 1/4W	745-0737-000
R2	Resistor, fixed, film, 2740Ω, 1%, 1/8W	705-1470-720
R3	Resistor, fixed, film, 232kΩ, 1%, 1/8W	705-3604-180
R4	Resistor, fixed, composition, 470kΩ, 10%, 1/4W	745-0845-000
R5	Resistor, fixed, composition, 470kΩ, 10%, 1/4W	745-0845-000
R6	Resistor, fixed, composition, 1500Ω, 10%, 1/4W	745-0755-000
R7	Resistor, fixed, film, 2740Ω, 1%, 1/8W	705-1470-720
R8	Resistor, fixed, film, 232kΩ, 1%, 1/8W	705-3604-180
R9	Resistor, fixed, composition, 470kΩ, 10%, 1/4W	745-0845-000
R10	Resistor, fixed, composition, 470kΩ, 10%, 1/4W	745-0845-000
R11	Resistor, fixed, composition, 1500Ω, 10%, 1/4W	745-0755-000
R12	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R13	Resistor, fixed, composition, 33kΩ, 10%, 1/4W	745-0803-000
R14	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R15	Resistor, fixed, composition, 15kΩ, 10%, 1/4W	745-0791-000
R16	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R17	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R18	Resistor, fixed, composition, 2700Ω, 10%, 1/4W	745-0764-000
R19	Resistor, fixed, film, 23.7kΩ, 0.1%, 1/10W	705-5976-200
R20	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R21	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R22	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R23	Resistor, fixed, film, 3160Ω, 1%, 1/8W	705-6285-000
R24	Resistor, variable, wire-wound, 5kΩ, 5%, 3/4W	381-1721-120
R25	Resistor, fixed, film, 6810Ω, 1%, 1/8W	705-6293-000
R26	Resistor, fixed, film, 61.9kΩ, 1%, 1/8W	705-6316-000

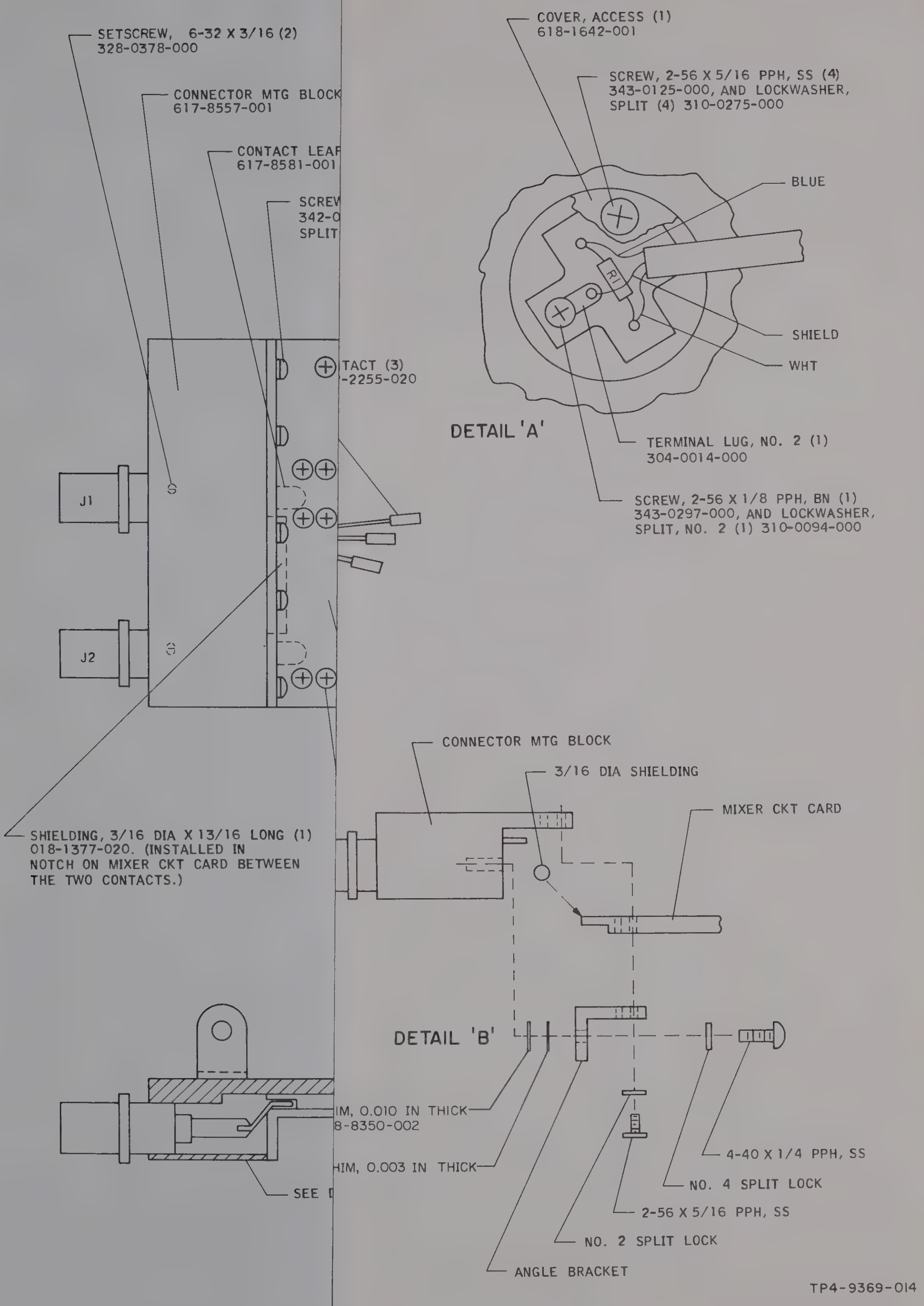
SYMBOL	DESCRIPTION	PART NUMBER
R27	Resistor, fixed, film, 3650Ω, 1%, 1/8W	705-1470-760
R28	Resistor, fixed, film, 14.7kΩ, 1%, 1/8W	705-1052-000
R29	Resistor, fixed, film, 38.3kΩ, 1%, 1/8W	705-1072-000
R30	Resistor, fixed, film, 38.3kΩ, 1%, 1/8W	705-1072-000
R31	Resistor, fixed, composition, 3300Ω, 10%, 1/4W	745-0767-000
R32	Resistor, fixed, composition, 3300Ω, 10%, 1/4W	745-0767-000
R33	Resistor, fixed, composition, 33kΩ, 10%, 1/4W	745-0803-000
R34	Resistor, fixed, composition, 33kΩ, 10%, 1/4W	745-0803-000
R35- R54	Not used	
R55	Resistor, fixed, film, 10kΩ, 1%, 1/8W	705-6297-000
R56	Resistor, fixed, film, 10kΩ, 1%, 1/8W	705-6297-000
R57	Resistor, fixed, film, 5110Ω, 1%, 1/8W	705-6290-000
R58- R63	Not used	
R64	Resistor, fixed, composition, 2700Ω, 10%, 1/4W	745-0764-000
R65- R74	Not used	
R75	Resistor, fixed, composition, 10MΩ, 10%, 1/4W	745-0893-000
R76	Resistor, fixed, composition, 4.7MΩ, 10%, 1/4W	745-0881-000
R77- R82	Not used	
R83	Resistor, fixed, composition, 330Ω, 10%, 1/4W	745-0731-000
R84	Resistor, fixed, composition, 18kΩ, 10%, 1/8W	745-2386-000
R85	Resistor, fixed, film, 4870Ω, 1%, 1/8W	705-1029-000
R86	Resistor, fixed, composition, 3300Ω, 10%, 1/4W	745-0767-000
RT1	Resistor, thermal, 1kΩ, 10%, 1/4W	714-2360-000
U1	Integrated circuit, UA709	351-7141-010
U2	Integrated circuit, UA709	351-7141-010
U3	Integrated circuit, UA741	351-1029-010
U4	Integrated circuit, UA741	351-1029-010
VR1	Zener diode, 1N758A, 10V	353-2724-000
VR2	Zener diode, 1N3016B, 6.8V	353-3046-000


P/O MODULATOR A3
(617-9311-001)
MODULATION OSC
INTEGRATOR DRIVER
INTEGRATOR
MODULATION
A3J3
- MOD DEV
+ MOD DEV
MOD FREQ
100 HZ 10
105 HZ 9
+21.5 VDC 11
+22 VDC RGLTD 15
-15 VDC RGLTD 13
RESERVED 14
XMTR REF SIG SHLD 2
CROSS CONNECT
NO.1 5
NO.2 3
MOD PHASE
180° 6
0° 1
P/O P1
R37 649
R38 536
R41 TEST SEL
C20 0.1
C21 0.1
R42 215K
C22 20 PF
U5 UA709
C23 560 PF
R44 1500
R45 3300
R82 750K
R43 750K
R36 22K
Q13 2N2907A
Q17 2N2222A
Q8 2N2222A
R35 10K
R40 82K
R77 10K
R78 12K
R79 47K
CR9 1N3064
C25 5
C26 5
R46 1K
R47 1K
C24 1
R39 10K
Q14 2N2222A
MOD OSC
A3J2
R49 56K
R80 22K
R48 22K
Q10 2N2907A
Q9 2N2222A
R53 15K
R52 15K
R51 10K
R50 10K
Q12 2N2222A
Q11 2N2907A
R54 10K
C27 22
U6 LM101A
R58 100K
C28 1
C29 33 PF
R63 10K
R60 10K
R59 82.5K
C37 0.47
A3R61 20K
CENTER FREQ ADJ
R62 12.1K
MOD
MODULATION
VOLTAGES ARE DC AND TAKEN WITH MOD PHASE AT 0°, MOD FREQ AT 100 Hz AND A4J4 GROUNDED
WOBBULATION GEN
VR2 1N3016B 6.8 V
C30 10
R29 38.3K
R32 3300
R31 3300
R30 38.2K
R86 3300
C19 1
C18 1
CR13 1N3064
CR6 1N3064
CR7 1N3064
CR14 1N3064
Q7 2N2222A
Q6 2N2222A
R34 33K
R33 33K
R85 4870
R28 14.7K
C3 33
A4J4
A4R24 5K
DEV ADJ
R25 6810
VR1 1N758A 10 V
R26 61.9K
C17 47
A3P1/A4P1 CONNECTOR
MODULATOR CONTROL A4
(619-9313-001)
FILTER/AMPL
ZERO CROSSING DET
FREQ TO VOLTAGE CONVERTER
-15 VDC RGLTD 13
XMTR REF SIG 16
XMTR REF SIG SHLD 2
+22 VDC RGLTD 15
CHASSIS GROUND 14
R84 18K
R83 330
R1 470
C1 0.1
C2 0.022
C3 0.022
C4 470 PF
R3 232K
R2 2740
U1 UA709
C7 20 PF
C6 560 PF
R6 1500
R4 470K
R5 470K
C5 1
C8 0.022
C9 0.022
C10 470 PF
R8 232K
R7 2740
U2 UA709
C13 20 PF
C12 560
R11 1500
R10 470K
C11 1
R9 470K
A4J1
C14 0.0047
R12 22K
Q1 2N2222A
R75 10 MEG
R14 10K
Q3 2N2907A
Q2 2N2222A
R76 4.7 MEG
R13 33K
R15 15K
R16 22K
C15 330 PF
CR1 1N3064
R18 2700
C16 0.0082
Q4 2N2540
R17 10K
CR3 1N3064
CR2 1N3064
R22 22K
CR8 1N3064
CR5 1N3064
CR4 1N3064
Q5 2N2540
R20 10K
R19 23.7K
R21 10K
RT1 1K
R23 3160
U3 UA741
R27 3650
R56 10K
R55 10K
U4 UA741
R57 5110
R64 2700
RESERVED
SELF TEST ALT SIG
637-2031

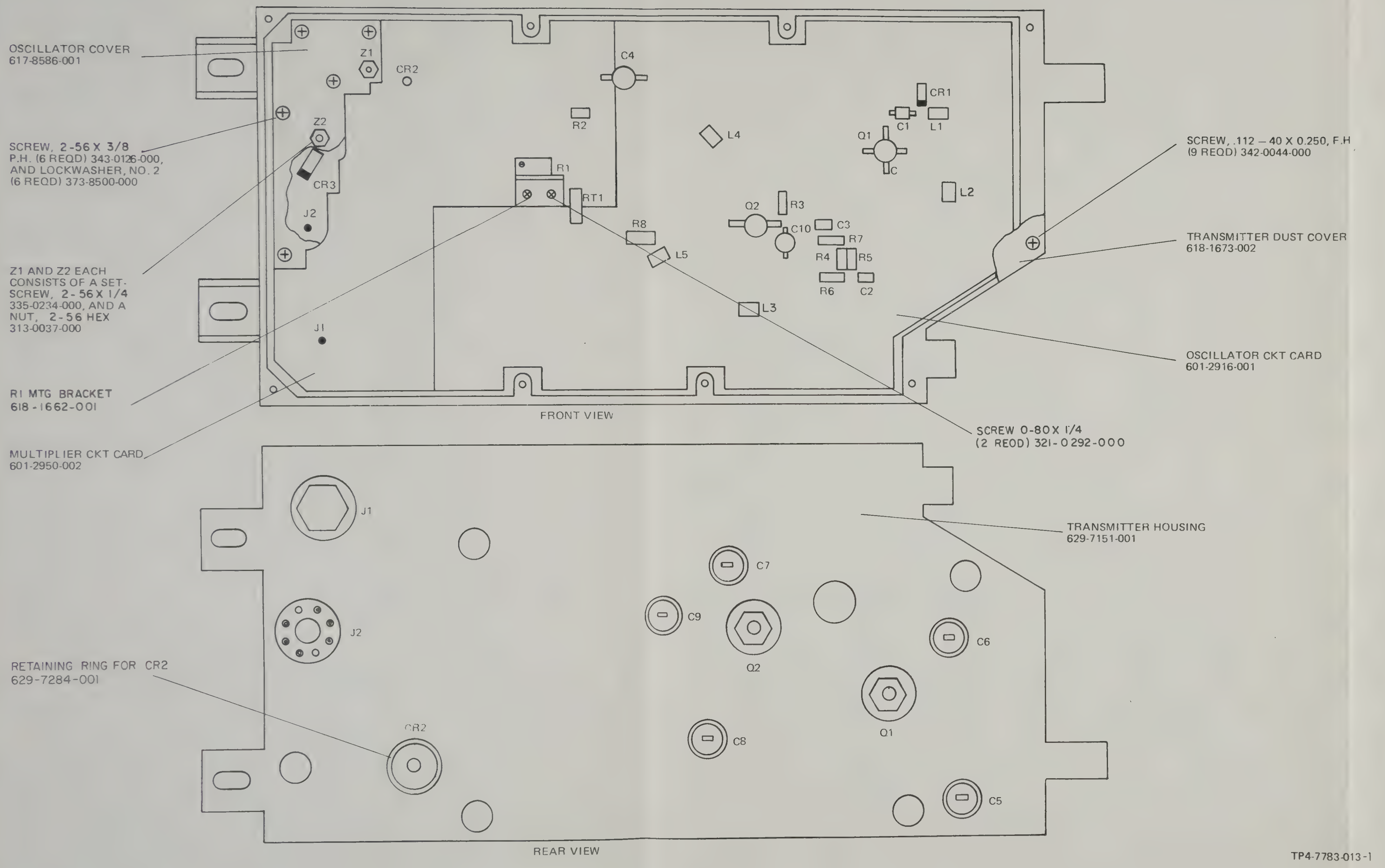
P/O Modulator A3 and Modulator Control A4, Schematic Diagram
Figure 6-7

13-1

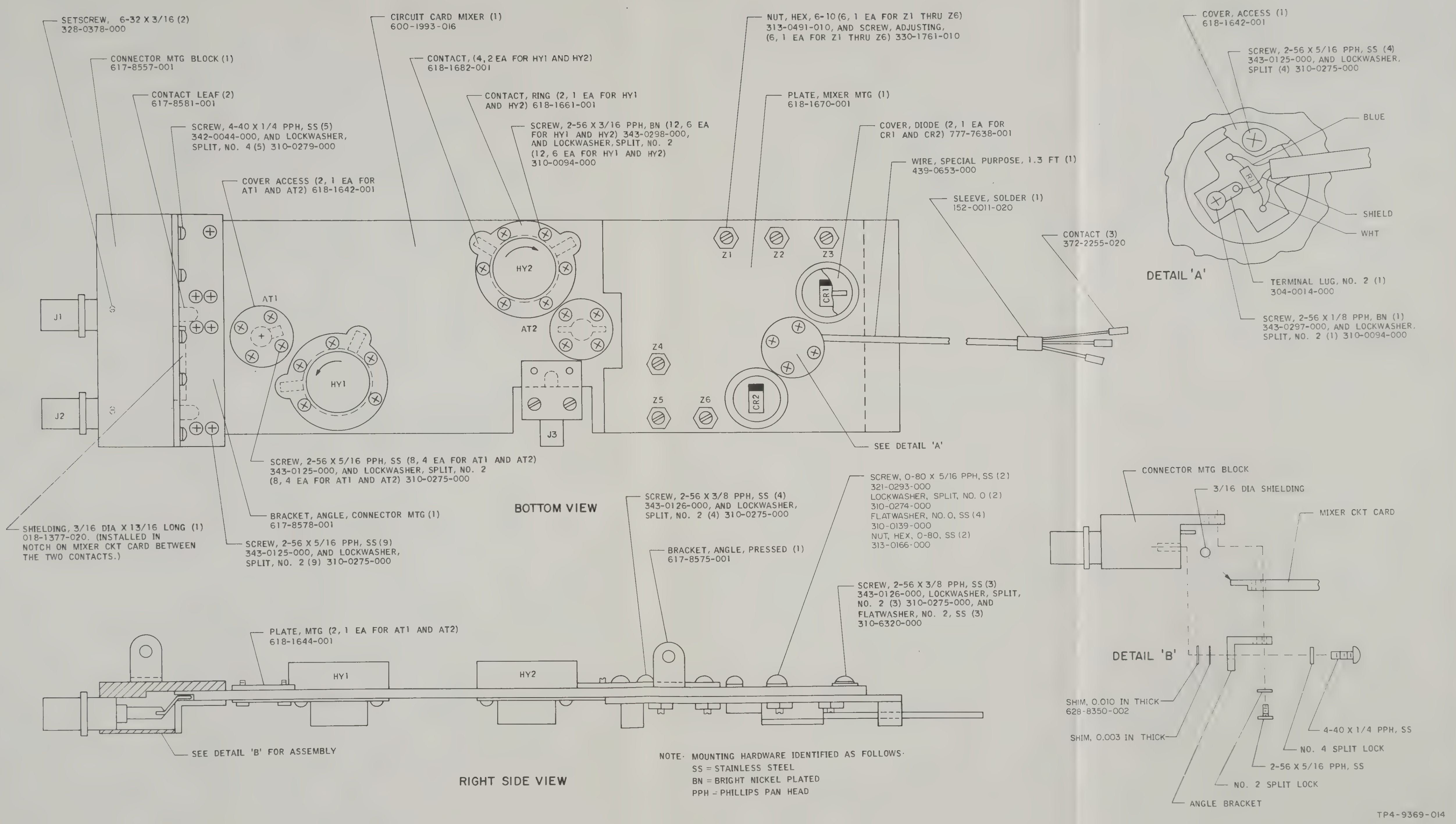
Transmitter A5, Component Location Diagram
Figure 6-8


SETSCREW, 6-32 X 3/16 (2)
328-0378-000
CONNECTOR MTG BLOCK
617-8557-001
CONTACT LEAF
617-8581-001
SCREW
342-0
SPLIT
TACT (3)
-2255-020
J1
J2
SHIELDING, 3/16 DIA X 13/16 LONG (1)
018-1377-020. (INSTALLED IN
NOTCH ON MIXER CKT CARD BETWEEN
THE TWO CONTACTS.)
IM, 0.010 IN THICK
8-8350-002
HIM, 0.003 IN THICK
SEE D
COVER, ACCESS (1)
618-1642-001
SCREW, 2-56 X 5/16 PPH, SS (4)
343-0125-000, AND LOCKWASHER,
SPLIT (4) 310-0275-000
BLUE
R1
SHIELD
WHT
DETAIL 'A'
TERMINAL LUG, NO. 2 (1)
304-0014-000
SCREW, 2-56 X 1/8 PPH, BN (1)
343-0297-000, AND LOCKWASHER,
SPLIT, NO. 2 (1) 310-0094-000
CONNECTOR MTG BLOCK
3/16 DIA SHIELDING
MIXER CKT CARD
DETAIL 'B'
4-40 X 1/4 PPH, SS
NO. 4 SPLIT LOCK
2-56 X 5/16 PPH, SS
NO. 2 SPLIT LOCK
ANGLE BRACKET
TP4-9369-014

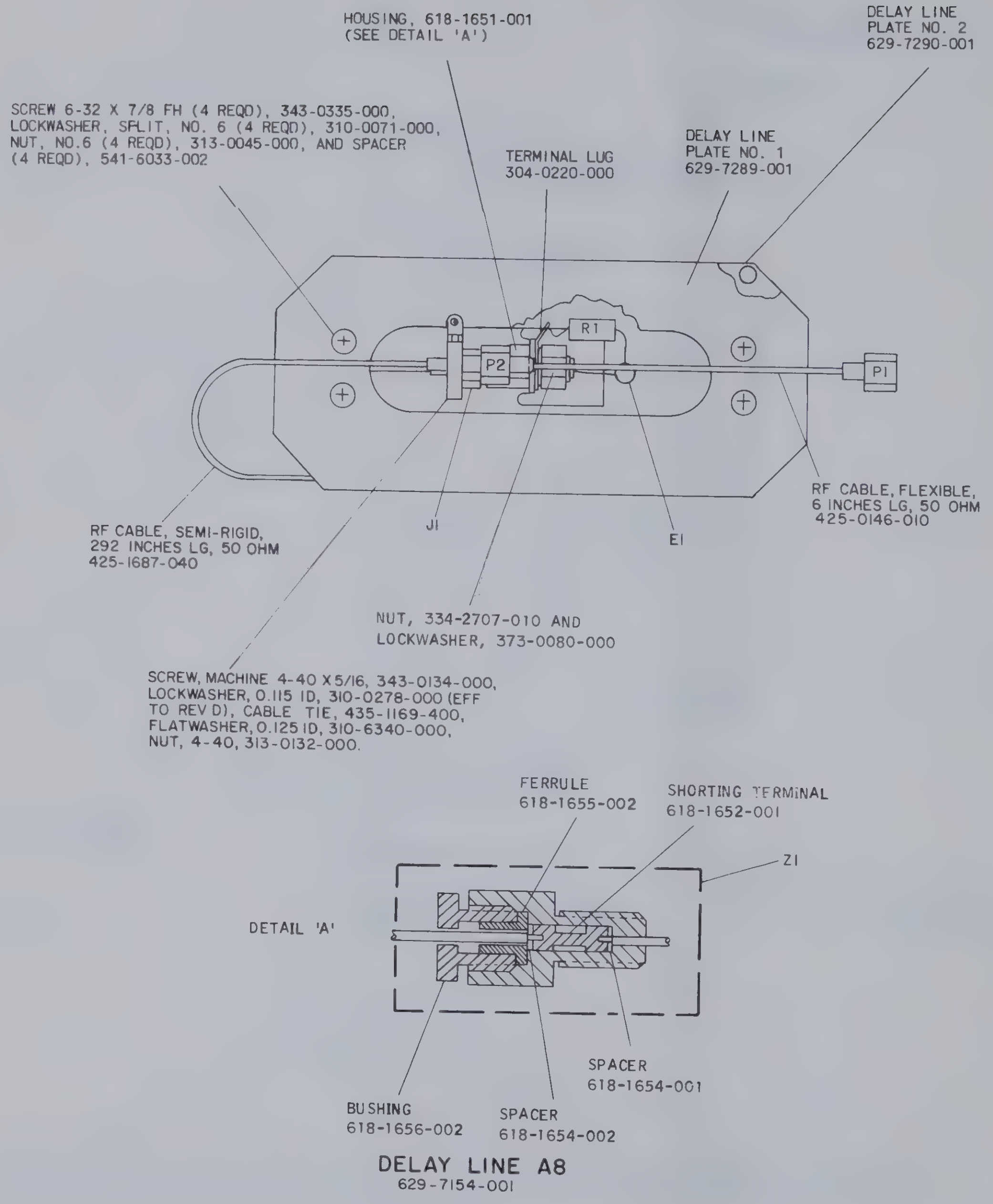
Mixer A7, Component Location Diagram
Figure 6-9


OSCILLATOR COVER
617-8586-001
SCREW, 2-56 X 3/8
P.H. (6 REQD) 343-0126-000,
AND LOCKWASHER, NO. 2
(6 REQD) 373-8500-000
Z1 AND Z2 EACH
CONSISTS OF A SET-
SCREW, 2-56 X 1/4
335-0234-000, AND A
NUT, 2-56 HEX
313-0037-000
R1 MTG BRACKET
618-1662-001
MULTIPLIER CKT CARD
601-2950-002
RETAINING RING FOR CR2
629-7284-001
Z1
CR2
Z2
CR3
J2
J1
C4
R2
R1
RT1
R8
L5
L4
Q2
R3
C10
C3
R7
R4
R5
R6
C2
L3
CR1
C1
L1
Q1
C
L2
FRONT VIEW
SCREW, .112 – 40 X 0.250, F.H
(9 REQD) 342-0044-000
TRANSMITTER DUST COVER
618-1673-002
OSCILLATOR CKT CARD
601-2916-001
SCREW 0-80 X 1/4
(2 REQD) 321-0292-000
TRANSMITTER HOUSING
629-7151-001
J1
J2
C9
C7
Q2
C6
CR2
C8
Q1
C5
REAR VIEW
TP4-7783-013-1

Transmitter A5, Component Location Diagram
Figure 6-8


SETSCREW, 6-32 X 3/16 (2)
328-0378-000
CONNECTOR MTG BLOCK (1)
617-8557-001
CONTACT LEAF (2)
617-8581-001
SCREW, 4-40 X 1/4 PPH, SS (5)
342-0044-000, AND LOCKWASHER,
SPLIT, NO. 4 (5) 310-0279-000
COVER ACCESS (2, 1 EA FOR
AT1 AND AT2) 618-1642-001
CIRCUIT CARD MIXER (1)
600-1993-016
CONTACT, (4, 2 EA FOR HY1 AND HY2)
618-1682-001
CONTACT, RING (2, 1 EA FOR HY1
AND HY2) 618-1661-001
SCREW, 2-56 X 3/16 PPH, BN (12, 6 EA
FOR HY1 AND HY2) 343-0298-000,
AND LOCKWASHER, SPLIT, NO. 2
(12, 6 EA FOR HY1 AND HY2)
310-0094-000
NUT, HEX, 6-10 (6, 1 EA FOR Z1 THRU Z6)
313-0491-010, AND SCREW, ADJUSTING,
(6, 1 EA FOR Z1 THRU Z6) 330-1761-010
PLATE, MIXER MTG (1)
618-1670-001
COVER, DIODE (2, 1 EA FOR
CR1 AND CR2) 777-7638-001
WIRE, SPECIAL PURPOSE, 1.3 FT (1)
439-0653-000
SLEEVE, SOLDER (1)
152-0011-020
CONTACT (3)
372-2255-020
J1
J2
J3
AT1
AT2
HY1
HY2
Z1
Z2
Z3
Z4
Z5
Z6
CR1
CR2
SEE DETAIL 'A'
SCREW, 2-56 X 5/16 PPH, SS (8, 4 EA FOR AT1 AND AT2)
343-0125-000, AND LOCKWASHER, SPLIT, NO. 2
(8, 4 EA FOR AT1 AND AT2) 310-0275-000
BRACKET, ANGLE, CONNECTOR MTG (1)
617-8578-001
SHIELDING, 3/16 DIA X 13/16 LONG (1)
018-1377-020. (INSTALLED IN
NOTCH ON MIXER CKT CARD BETWEEN
THE TWO CONTACTS.)
SCREW, 2-56 X 5/16 PPH, SS (9)
343-0125-000, AND LOCKWASHER,
SPLIT, NO. 2 (9) 310-0275-000
BOTTOM VIEW
SCREW, 2-56 X 3/8 PPH, SS (4)
343-0126-000, AND LOCKWASHER,
SPLIT, NO. 2 (4) 310-0275-000
BRACKET, ANGLE, PRESSED (1)
617-8575-001
SCREW, 0-80 X 5/16 PPH, SS (2)
321-0293-000
LOCKWASHER, SPLIT, NO. 0 (2)
310-0274-000
FLATWASHER, NO. 0, SS (4)
310-0139-000
NUT, HEX, 0-80, SS (2)
313-0166-000
SCREW, 2-56 X 3/8 PPH, SS (3)
343-0126-000, LOCKWASHER, SPLIT,
NO. 2 (3) 310-0275-000, AND
FLATWASHER, NO. 2, SS (3)
310-6320-000
PLATE, MTG (2, 1 EA FOR AT1 AND AT2)
618-1644-001
HY1
HY2
SEE DETAIL 'B' FOR ASSEMBLY
RIGHT SIDE VIEW
NOTE: MOUNTING HARDWARE IDENTIFIED AS FOLLOWS:
SS = STAINLESS STEEL
BN = BRIGHT NICKEL PLATED
PPH = PHILLIPS PAN HEAD
COVER, ACCESS (1)
618-1642-001
SCREW, 2-56 X 5/16 PPH, SS (4)
343-0125-000, AND LOCKWASHER,
SPLIT (4) 310-0275-000
BLUE
R1
SHIELD
WHT
DETAIL 'A'
TERMINAL LUG, NO. 2 (1)
304-0014-000
SCREW, 2-56 X 1/8 PPH, BN (1)
343-0297-000, AND LOCKWASHER,
SPLIT, NO. 2 (1) 310-0094-000
CONNECTOR MTG BLOCK
3/16 DIA SHIELDING
MIXER CKT CARD
DETAIL 'B'
SHIM, 0.010 IN THICK
628-8350-002
SHIM, 0.003 IN THICK
4-40 X 1/4 PPH, SS
NO. 4 SPLIT LOCK
2-56 X 5/16 PPH, SS
NO. 2 SPLIT LOCK
ANGLE BRACKET
TP4-9369-014

Mixer A7, Component Location Diagram
Figure 6-9


HOUSING, 618-1651-001
(SEE DETAIL 'A')
DELAY LINE
PLATE NO. 2
629-7290-001
SCREW 6-32 X 7/8 FH (4 REQD), 343-0335-000,
LOCKWASHER, SPLIT, NO. 6 (4 REQD), 310-0071-000,
NUT, NO.6 (4 REQD), 313-0045-000, AND SPACER
(4 REQD), 541-6033-002
TERMINAL LUG
304-0220-000
DELAY LINE
PLATE NO. 1
629-7289-001
R1
P2
P1
RF CABLE, FLEXIBLE,
6 INCHES LG, 50 OHM
425-0146-010
RF CABLE, SEMI-RIGID,
292 INCHES LG, 50 OHM
425-1687-040
J1
E1
NUT, 334-2707-010 AND
LOCKWASHER, 373-0080-000
SCREW, MACHINE 4-40 X 5/16, 343-0134-000,
LOCKWASHER, 0.115 ID, 310-0278-000 (EFF
TO REV D), CABLE TIE, 435-1169-400,
FLATWASHER, 0.125 ID, 310-6340-000,
NUT, 4-40, 313-0132-000.
FERRULE
618-1655-002
SHORTING TERMINAL
618-1652-001
Z1
DETAIL 'A'
SPACER
618-1654-001
BUSHING
618-1656-002
SPACER
618-1654-002
DELAY LINE A8
629-7154-001

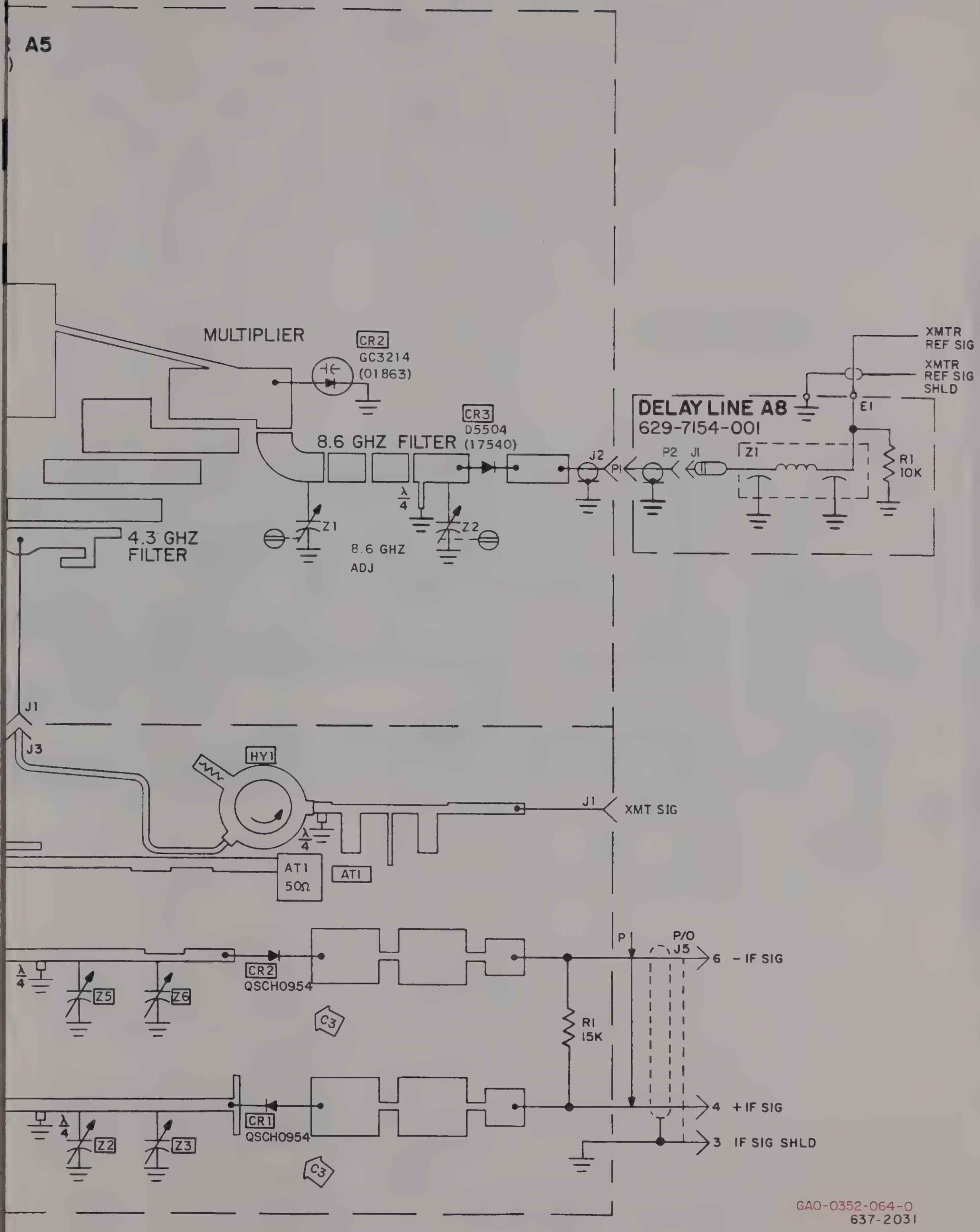
TP4-8052-014

Delay Line A8, Component Location Diagram
Figure 6-10

SCHEMATIC CHANGES

REVISION IDENTIFICATION	DESCRIPTION OF REVISION AND REASON FOR CHANGE	SERVICE BULLETIN	EFFECTIVITY
	Below are schematic corrections that apply to all units.		
None	Added connectors A8J1, P1, and P2; added +21.5 V dc output at A3L1/C36 junction; added inductance value (1.25 mH) at A3L1.	None	All units
C3	Changed diodes A7CR1, CR2 from HP2566 to QSCH0954, vendor availability.	None	601-2917-001 REV C

P/O Modulator A3, Transmitter A5, Mixer A7, and Delay Line A8, Schematic Diagram
Figure 6-11 (Sheet A)


A5
MULTIPLIER
CR2
GC3214
(01863)
CR3
D5504
(17540)
8.6 GHZ FILTER
4.3 GHZ FILTER
Z1
Z2
λ/4
8.6 GHZ ADJ
J2
P1
P2
J1
DELAY LINE A8
629-7154-001
E1
Z1
R1
10K
XMTR REF SIG
XMTR REF SIG SHLD
J1
J3
HY1
AT1
50Ω
AT1
J1
XMT SIG
CR2
QSCH0954
Z5
Z6
C3
R1
15K
P
P/O
J5
6 − IF SIG
4 + IF SIG
3 IF SIG SHLD
CR1
QSCH0954
Z2
Z3
C3
GA0-0352-064-0
637-2031

P/O Modulator A3, Transmitter A5, Mixer A7, and Delay Line A8, Schematic Diagram
Figure 6-11

PARTS LIST
TRANSMITTER A5 (PART NUMBER 629-7152-001)
LATEST EFFECTIVITY: REV H

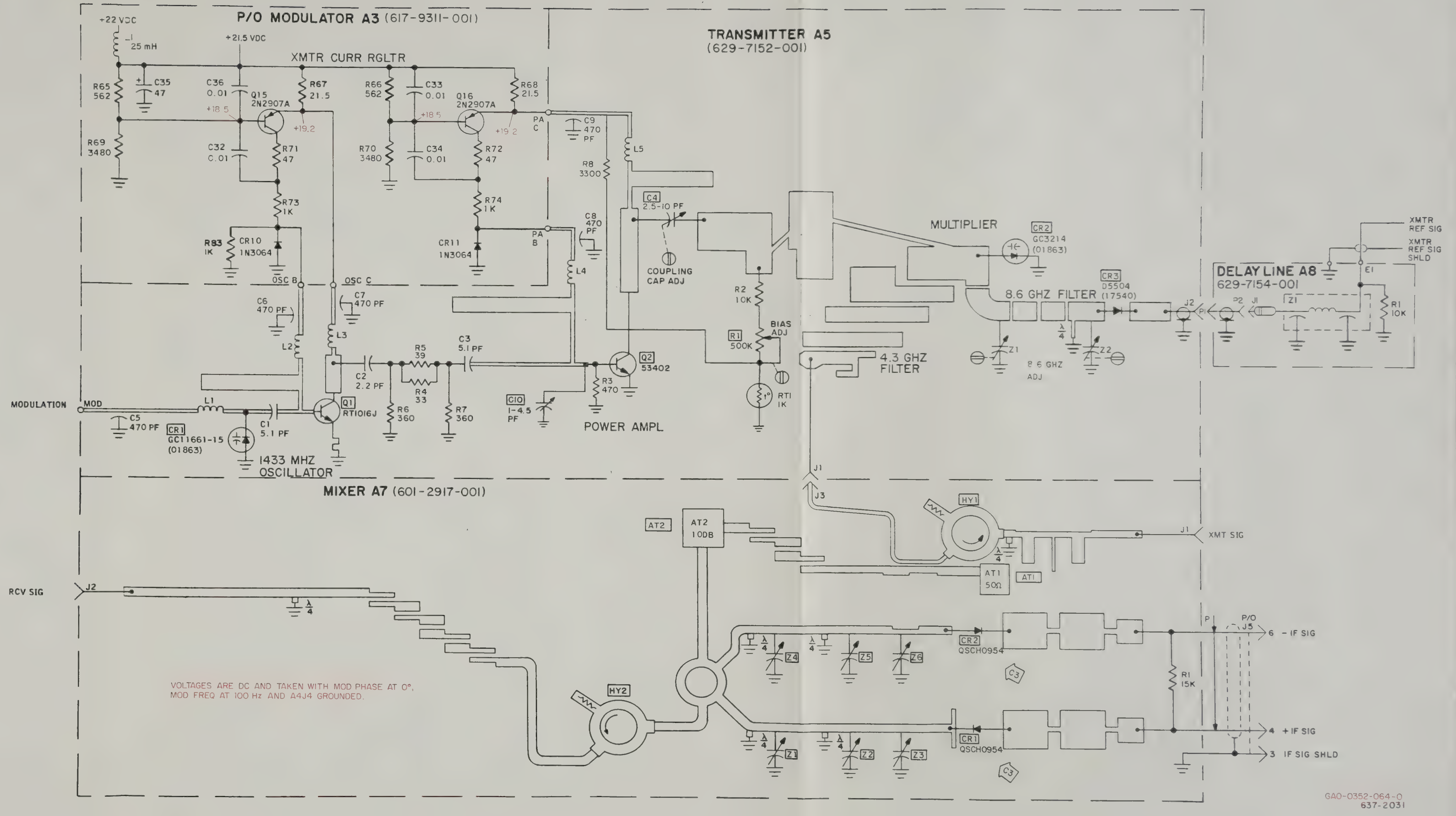
SYMBOL	DESCRIPTION	PART NUMBER
C1	Capacitor, fixed, ceramic, dielectric, 5.1pF, 5%, 500V	914-3098-540
C2	Capacitor, fixed, ceramic, dielectric, 2.2pF, ±25pF, 500V	914-3098-710
C3	Capacitor, fixed, ceramic, dielectric, 5.1pF, 5%, 500V	914-3098-540
C4	Capacitor, variable, ceramic, dielectric, 2.5 to 10 pF, 250V (eff thru REV G)	917-0005-040
C4	Capacitor, ceramic dielectric, 2.5 to 10 pF, 250V (eff REV H)	917-0501-160
C5	Capacitor, fixed, ceramic, dielectric, 470pF, 20%, 500V	913-1298-030
C6	Capacitor, fixed, ceramic, dielectric, 470pF, 20%, 500V	913-1298-030
C7	Capacitor, fixed, ceramic, dielectric, 470pF, 20%, 500V	913-1298-030
C8	Capacitor, fixed, ceramic, dielectric, 470pF, 20%, 500V	913-1298-030
C9	Capacitor, fixed, ceramic, dielectric, 470pF, 20%, 500V	913-1298-030
C10	Capacitor, variable, ceramic, dielectric, 1 to 4.5 pF, 250V (eff thru REV G)	917-0005-060
C10	Capacitor, ceramic dielectric 1 to 4.5 pF, 250V (eff REV H)	917-0501-120
CR1	Diode, GC11661-15	922-6104-020
CR2	Diode, GC3214	922-6201-010
CR3	Diode, D5504	353-3680-030
J1	Connector, receptacle, electrical	357-7207-130
J2	Connector, electrical	357-7484-030
L1	Coil, radio frequency	618-1688-001
L2	Coil, ferrite bead	288-0815-010
L3	Coil, ferrite bead	288-0815-010
L4	Coil, ferrite bead	288-0815-010
L5	Coil, ferrite bead	288-0815-010
Q1	Transistor, RT1016J	352-1059-030
Q2	Transitor, power, 53402	352-1100-010
R1	Resistor, variable, nonwire-wound, 500kΩ, 10%, 1/2W	380-1080-670
R2	Resistor, fixed, composition, 10kΩ, 10%, 1/8W	745-2377-000
R3	Resistor, fixed, composition, 470Ω, 10%, 1/8W	745-2329-000
R4	Resistor, fixed, composition, 33Ω, 5%, 1/8W	745-1863-130
R5	Resistor, fixed, composition, 39Ω, 5%, 1/8W	745-1863-150
R6	Resistor, fixed, composition, 360Ω, 5%, 1/8W	745-1863-380
R7	Resistor, fixed, composition, 360Ω, 5%, 1/8W	745-1863-380
R8	Resistor, fixed, composition, 3.3kΩ, 5%, 1/8W	745-2359-000
RT1	Resistor, thermal, 1kΩ, 10%, 8MW	714-3239-050

MIXER A7 (PART NUMBER 601-2917-001)
LATEST EFFECTIVITY: REV C

AT1	Load, 50Ω, 1W	713-0073-030
AT2	Attenuator, 10dB	379-0540-040
CR1	Diode, HP2566 (eff to REV C)	353-3680-020
CR1	Diode, QSCH0954 (eff REV C)	353-3680-050
CR2	Diode, HP2566 (eff to REV C)	353-3680-020
CR2	Diode, QSCH0954 (eff REV C)	353-3680-050
HY1	Hybrid isolator, cw	355-0487-010
HY2	Hybrid isolator, ccw	355-0487-020
J1	Connector, TNC	357-9516-000
J2	Connector, TNC	357-9516-000
J3	Connector, receptacle	357-7485-010
R1	Resistor, fixed, composition, 15kΩ, 10%, 1/8W	745-2383-000

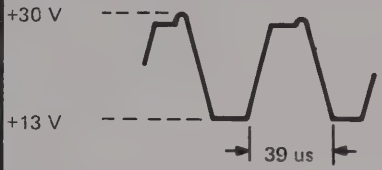
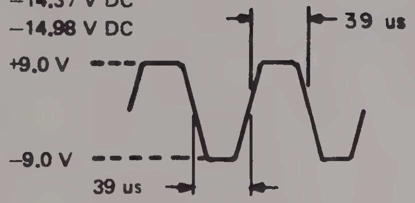
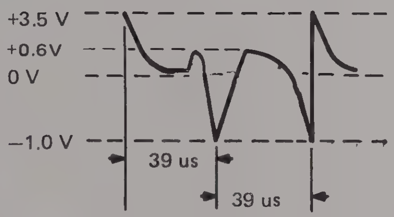
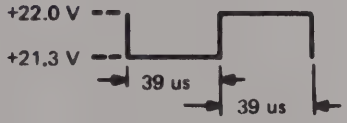
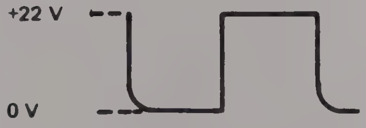
DELAY LINE A8 (PART NUMBER 629-7154-001)
LATEST EFFECTIVITY: REV E

J1	Connector	357-7433-060
P1	Connector, plug	357-7114-020
P2	Connector, plug	357-7114-020
R1	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000


P/O MODULATOR A3 (617-9311-001)
TRANSMITTER A5 (629-7152-001)
+22 VDC
25 mH
+21.5 VDC
XMTR CURR RGLTR
R65 562
C35 47
C36 0.01
R67 21.5
Q15 2N2907A
+18.5
+19.2
R66 562
C33 0.01
Q16 2N2907A
R68 21.5
PA C
C9 470 PF
R69 3480
C32 0.01
R71 47
R70 3480
C34 0.01
R72 47
L5
R8 3300
R73 1K
R74 1K
R83 1K
CR10 1N3064
CR11 1N3064
PA B
C8 470 PF
C4 2.5-10 PF
COUPLING CAP ADJ
L4
MULTIPLIER
CR2 GC3214 (01863)
XMTR REF SIG
XMTR REF SIG SHLD
DELAY LINE A8 629-7154-001
E1
CR3 D5504 (17540)
8.6 GHZ FILTER
J2
P1
P2
J1
Z1
R1 10K
R2 10K
BIAS ADJ
R1 500K
Z1
Z2
8.6 GHZ ADJ
4.3 GHZ FILTER
OSC B
OSC C
C6 470 PF
C7 470 PF
L3
L2
C3 5.1 PF
R5 39
R4 33
C2 2.2 PF
Q2 53402
R3 470
MODULATION
MOD
L1
C5 470 PF
CR1 GC11661-15 (01863)
C1 5.1 PF
Q1 RT1016J
R6 360
R7 360
C10 1-4.5 PF
POWER AMPL
RT1 1K
1433 MHZ OSCILLATOR
J1
J3
MIXER A7 (601-2917-001)
HY1
AT2
AT2 10DB
J1
XMT SIG
λ/4
AT1 50Ω
AT1
RCV SIG
J2
λ/4
P
P/O J5
6 - IF SIG
Z4
Z5
Z6
CR2 QSCH0954
C3
R1 15K
HY2
Z1
Z2
Z3
CR1 QSCH0954
4 + IF SIG
3 IF SIG SHLD
VOLTAGES ARE DC AND TAKEN WITH MOD PHASE AT 0°, MOD FREQ AT 100 Hz AND A4J4 GROUNDED.
GA0-0352-064-0
637-2031

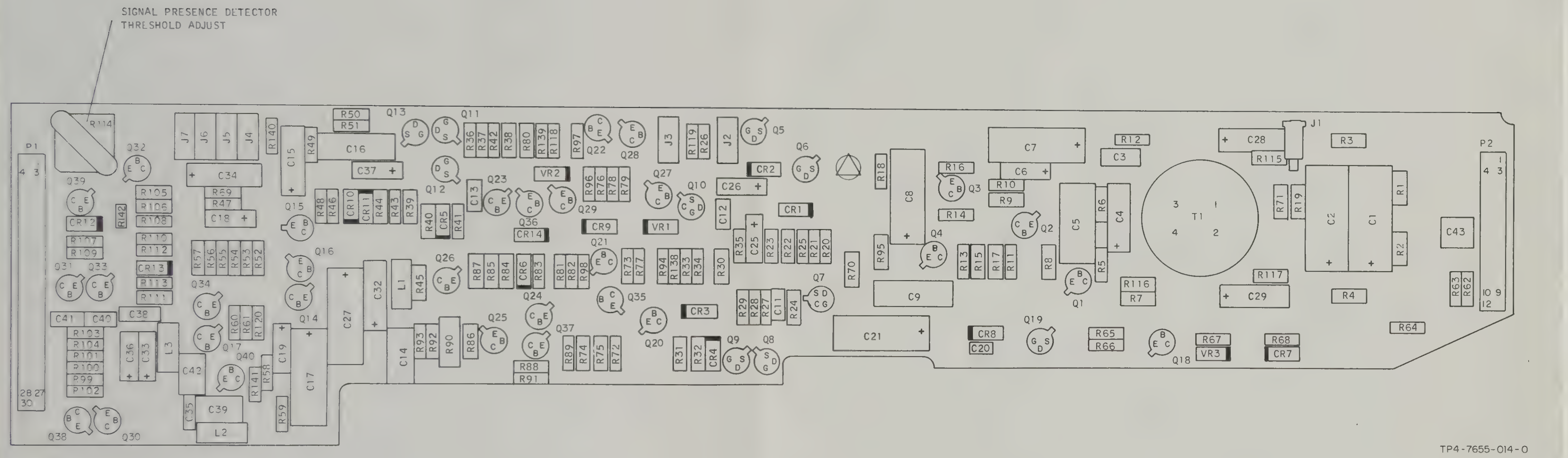
P/O Modulator A3, Transmitter A5, Mixer A7, and Delay Line A8, Schematic Diagram
Figure 6-11

Preamplifier/Filter A2, Component Location Diagram
Figure 6-12

ST INT	TYPICAL WAVEFORM OR NOMINAL VOLTAGE	TEST POINT	TYPICAL WAVEFORM OR NOMINAL VOLTAGE
	INPUT: AUDIO SIG AT A2J1—12,870 Hz, 5 V RMS OUT OF AUDIO SIG GEN TO TEST FIXTURE INPUT. AID = 40 FT.		
	PREAMP/FILTER A2		PREAMP/FILTER A2
5-C	+0.28 V DC	Q34-B	 +30 V +13 V 39 us
6-B	+0.10 V DC		
6-C	+6.75 V DC		
7-B	−14.35 V DC		
7-C	−14.99 V DC		
8-B	+0.01 V DC		
8-C	+6.80 V DC	Q34-E	SEE Q34-B
9-B	−14.37 V DC	Q34-C	+15.70 V DC
9-C	−14.98 V DC	Q35-B	+6.57 VDC
0-B	 39 us +9.0 V −9.0 V 39 us	Q35-C	+21.31 V DC
		Q36-B	+6.42 V DC
		Q36-C	+21.9 V DC
		Q37-B	+6.34 V DC
		Q37-C	+21.90 V DC
		Q39-B	+5.73 V DC
0-E	+3.0 V DC	Q40-B	+10.38 V DC
		Q40-E	+9.8 V DC
8-B	 +3.5 V +0.6V 0 V −1.0 V 39 us 39 us		
3-C	 +22.0 V +21.3 V 39 us 39 us		
1-C			
2-B	+15.70 V DC		
2-E	+15.11 V DC		
2-C	+21.31 V DC		
3-C	+21.95 V DC		

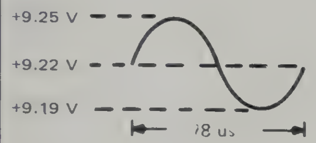
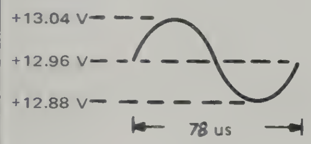
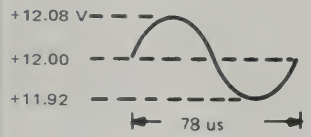
TP4-9392-013

Preamplifier/Filter A2, Voltages and Waveforms
Figure 6-13

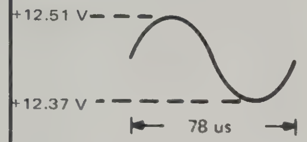
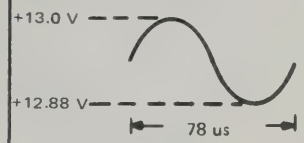
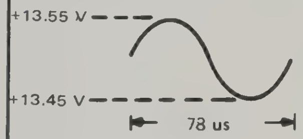
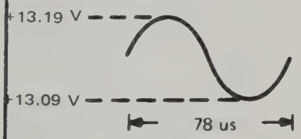

SIGNAL PRESENCE DETECTOR
THRESHOLD ADJUST
R114
P1
4 3
28 27
30
Q32
Q39
CR12
R142
R105
R106
R108
R107
R109
R110
R112
CR13
R113
R111
Q31
Q33
C41
C40
C38
R103
R104
R101
R100
R99
R102
C36
C33
L3
C42
C35
C39
L2
Q38
Q30
J7
J6
J5
J4
C34
R69
R47
C18
R57
R56
R55
R54
R53
R52
Q34
Q17
Q40
R60
R61
R120
R141
R58
R140
C15
R49
Q15
Q16
Q14
C19
C17
R59
C27
C32
L1
R45
C14
R50
R51
C16
C37
R48
R46
CR10
CR11
R44
R43
R39
Q13
Q11
Q12
R36
R37
R42
R38
R80
R139
R118
R40
CR5
R41
C13
Q23
Q36
CR14
R93
R92
R90
R86
Q26
Q25
R87
R85
R84
CR6
R83
Q24
Q37
R88
R91
VR2
R97
Q22
Q28
Q29
R96
R76
R78
R79
CR9
Q21
R81
R82
R98
R89
R74
R75
R72
Q35
R73
R77
J3
Q27
VR1
R94
R138
R33
R34
Q20
CR3
R31
R32
CR4
Q9
Q8
R119
R26
J2
Q10
C26
C12
R30
Q5
CR2
Q6
C25
R35
R23
CR1
R22
R25
R21
R20
R29
R28
R27
C11
R24
Q7
R70
R18
R95
C8
Q4
C9
C21
R16
Q3
R14
R13
R15
R17
R11
C7
C6
R10
R9
Q2
R8
CR8
C20
Q19
R12
C3
C5
R6
C4
R5
Q1
R116
R7
R65
R66
Q18
R67
VR3
T1
3 1
4 2
C28
R115
J1
R117
C29
R68
CR7
R3
R71
R19
C2
C1
R1
R2
R4
C43
R64
P2
4 3
R63
R62
10 9
12
TP4-7655-014-0

Preamplifier/Filter A2, Component Location Diagram
Figure 6-12

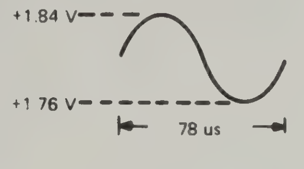
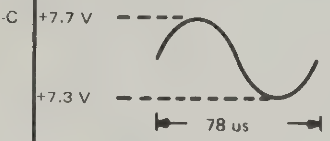
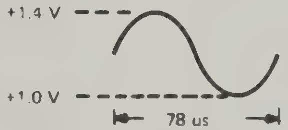
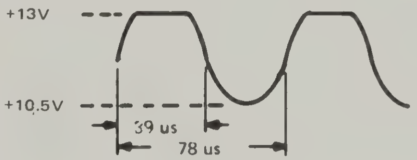
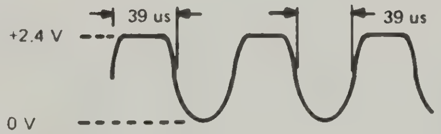
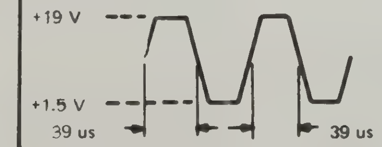
INPUT: AUDIO SIG AT A2J1–12,870 Hz, 5 V RMS OUT OF AUDIO SIG GEN TO TEST FIXTURE INPUT AID = 40 FT

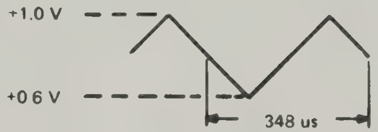
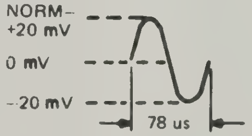
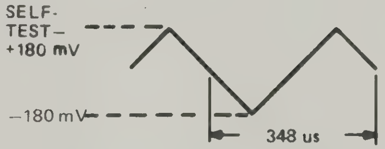
TEST POINT	TYPICAL WAVEFORM OR NOMINAL VOLTAGE
	PREAMP/FILTER A2
Q1-B	+3.78 V DC
Q1-C	+9.22 V DC
Q2-B	
Q2-E	+8.85 V DC
Q2-C	+17.96 V DC
Q3-B	+3.40 V DC
Q3-E	+2.82 V DC
Q3-C	
Q4-B	+12.96 V DC
Q4-E	
Q4-C	+19.18 V DC
J2 *	–4.67 V DC
Q5-G	–1.22 V DC
Q5-S	+12.00 V DC
Q5-D	+12.51 V DC
J3 *	–4.50 V DC
Q6-G	–1.41 V DC
Q6-S	+12.00 V DC
Q6-D	+12.41 V DC

*J2 AND J3 VOLTAGES ARE WHEN 12,870 Hz IS APPROACHED FROM BELOW.

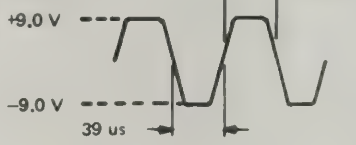
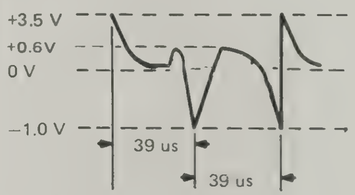
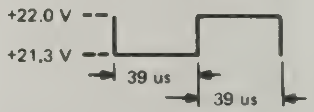
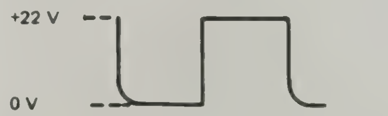
TEST POINT	TYPICAL WAVEFORM OR NOMINAL VOLTAGE
	PREAMP/FILTER A2
Q7-G	
Q8-G	–1.19 V DC
Q8-S	+13.01 V DC
Q8-D	+12.88 V DC
Q9-G	–1.22 V DC
Q9-S	+13.01 V DC
Q9-D	+12.91 V DC
Q10-G	
Q11-G	–1.19 V DC
Q11-S	+13.57 V DC
Q11-D	+13.43 V DC
Q12-G	–1.17 V DC
Q12-S	+13.57 V DC
Q12-D	+13.47 V DC
Q13-G	
Q14-B	+13.78 V DC
Q14-E	
Q14-C	+20.66 V DC

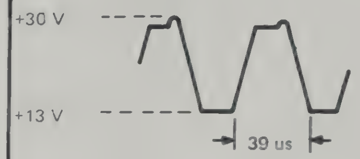
INPUT: AUDIO SIG AT A2J1–12,870 Hz, 5 V RMS OUT OF AUDIO SIG GEN TO TEST FIXTURE INPUT. AID = 40 FT.

TEST POINT	TYPICAL WAVEFORM OR NOMINAL VOLTAGE
	PREAMP/FILTER A2
Q15-B	
Q15-E	+1.14 V DC
Q15-C	
Q16-B	
Q16-E	+0.55 V DC
Q16-C	
Q17-B	
Q17-E	+0.88 V DC
Q17-C (J4)	

TEST POINT	TYPICAL WAVEFORM OR NOMINAL VOLTAGE
	PREAMP/FILTER A2
Q18-B	NORM– –14.3 V DC SELF-TEST– –15.0 V DC
Q18-C	NORM– –15.0 V DC SELF-TEST– +21.7 V DC
Q19-G	NORM– –9.8 V DC SELF-TEST– +0.9 V DC
Q19-S	
Q19-D	 
Q20-B	+6.42 V DC
Q20-E	+5.87 V DC
Q20-C	+21.97 V DC
Q21-C	+21.96 V DC
Q22-B	+21.92 V DC
Q22-E	+21.96 V DC
Q22-C	+0.02 V DC
Q23-B	+11.58 V DC
Q23-E	+11.02 V DC
Q24-E	+12.02 V DC
Q24-B	+12.60 V DC
Q24-C	+21.97 V DC

INPUT: AUDIO SIG AT A2J1–12,870 Hz, 5 V RMS OUT OF AUDIO SIG GEN TO TEST FIXTURE INPUT. AID = 40 FT.

TEST POINT	TYPICAL WAVEFORM OR NOMINAL VOLTAGE
	PREAMP/FILTER A2
Q25-C	+0.28 V DC
Q26-B	+0.10 V DC
Q26-C	+6.75 V DC
Q27-B	–14.35 V DC
Q27-C	–14.99 V DC
Q28-B	+0.01 V DC
Q28-C	+6.80 V DC
Q29-B	–14.37 V DC
Q29-C	–14.98 V DC
Q30-B	
Q30-E	+3.0 V DC
Q38-B	
Q38-C	
Q31-C	
Q32-B	+15.70 V DC
Q32-E	+15.11 V DC
Q32-C	+21.31 V DC
Q33-C	+21.95 V DC

TEST POINT	TYPICAL WAVEFORM OR NOMINAL VOLTAGE
	PREAMP/FILTER A2
Q34-B	
Q34-E	SEE Q34-B
Q34-C	+15.70 V DC
Q35-B	+6.57 VDC
Q35-C	+21.31 V DC
Q36-B	+6.42 V DC
Q36-C	+21.9 V DC
Q37-B	+6.34 V DC
Q37-C	+21.90 V DC
Q39-B	+5.73 V DC
Q40-B	+10.38 V DC
Q40-E	+9.8 V DC

TP4-9392-013

Preamplifier/Filter A2, Voltages and Waveforms
Figure 6-13

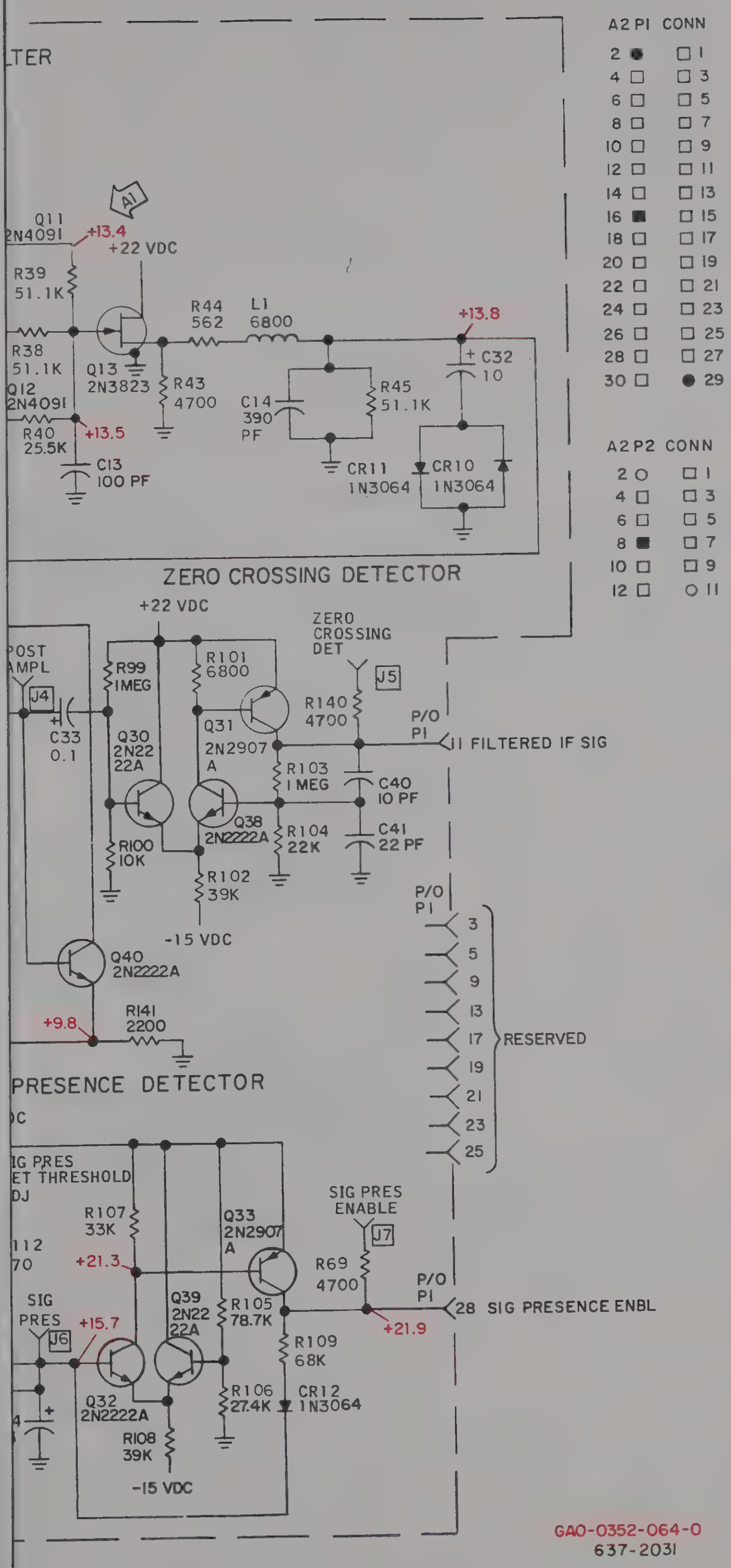
SCHEMATIC CHANGES

REVISION IDENTIFICATION	DESCRIPTION OF REVISION AND REASON FOR CHANGE	SERVICE BULLETIN	EFFECTIVITY
A1	Changed transistors Q5, Q6, Q8, Q9, Q11, and Q12 from type 2N4092 to 2N4091 to prevent momentary dropout at approximately 800 ft during climbout.	SB 1 (-001 only)	ALT-50A (622-3201-001) with serial number 206 and above ALT-50A (622-3201-002) all units
None	Changed A2R19 from 5100 to 5110; added A2P1-3, -5, -9, -13, -17, -19, -21, -23, and -25, schematic correction.	None	All units

Preamplifier/Filter A2, Schematic Diagram
Figure 6-14 (Sheet A)

PARTS LIST
PREAMP/FILTER CIRCUIT CARD ASSEMBLY A2 (PART NUMBER 617-9092-004)
LATEST EFFECTIVITY: REV AW

SYMBOL	DESCRIPTION	PART NUMBER
C1	Capacitor, fixed, electrolytic, 330μF, 20%, 6V	184-7647-000
C2	Capacitor, fixed, electrolytic, 330μF, 20%, 6V	184-7647-000
C3	Capacitor, fixed, mica dielectric, 470pF, 5%, 100V	912-2093-160
C3	Capacitor, fixed, mica dielectric, 510pF, 5%, 100V	912-2093-170
C3	Capacitor, fixed, mica dielectric, 560pF, 5%, 100V	912-2093-180
C3	Capacitor, fixed, mica dielectric, 620pF, 5%, 100V	912-2093-190
C3	Capacitor, fixed, mica dielectric, 680pF, 5%, 500V	912-2093-200
C3	Capacitor, fixed, mica dielectric, 750pF, 5%, 100V	912-2093-210
C3	Capacitor, fixed, mica dielectric, 820pF, 5%, 100V	912-2093-220
C3	Capacitor, fixed, mica dielectric, 910pF, 5%, 100V	912-2093-230
C3	Capacitor, fixed, mica dielectric, 1000pF, 5%, 100V	912-2093-240
C3	Capacitor, fixed, mica dielectric, 1100pF, 5%, 100V	912-2093-250
C3	Capacitor, fixed, mica dielectric, 1200pF, 5%, 100V	912-2093-260
C4	Capacitor, fixed, electrolytic, 2.2μF, 20%, 35V	184-7397-000
C5	Capacitor, fixed, mica dielectric, 3900pF, 5%, 500V	912-3046-000
C6	Capacitor, fixed, electrolytic, 0.1μF, 20%, 35V	184-7408-000
C7	Capacitor, fixed, electrolytic, 22μF, 20%, 35V	184-9086-670
C8	Capacitor, fixed, electrolytic, 22μF, 20%, 35V	184-9086-670
C9	Capacitor, fixed, mica dielectric, 1300pF, 5%, 500V	912-3010-000
C10	Not used	
C11	Capacitor, fixed, mica dielectric, 100pF, 5%, 50V	912-4141-050
C12	Capacitor, fixed, mica dielectric, 100pF, 5%, 50V	912-4141-050
C13	Capacitor, fixed, mica dielectric, 100pF, 5%, 50V	912-4141-050
C14	Capacitor, fixed, mica dielectric, 390pF, 5%, 500V	912-2858-000
C15	Capacitor, fixed, electrolytic, 4.7μF, 20%, 35V	184-7396-001
C16	Capacitor, fixed, mica dielectric, 1000pF, 5%, 500V	912-3001-000
C17	Capacitor, fixed, electrolytic, 10μF, 10%, 50V	184-9087-610
C18	Capacitor, fixed, electrolytic, 1μF, 20%, 35V	184-7398-000
C19	Capacitor, fixed, electrolytic, 1μF, 20%, 35V	184-7398-000
C20	Capacitor, fixed, ceramic dielectric, 0.1μF, 10%, 50V	913-5019-320
C21	Capacitor, fixed, electrolytic, 22μF, 20%, 35V	184-9086-670
C22- C24	Not used	
C25	Capacitor, fixed, electrolytic, 1μF, 20%, 50V	184-9087-440
C26	Capacitor, fixed, electrolytic, 1μF, 20%, 50V	184-9087-440
C27	Capacitor, fixed, electrolytic, 22μF, 20%, 35V	184-9086-670
C28	Capacitor, fixed, electrolytic, 10μF, 20%, 20V	184-7375-000
C29	Capacitor, fixed, electrolytic, 10μF, 20%, 20V	184-7375-000
C30- C31	Not used	
C32	Capacitor, fixed, electrolytic, 10μF, 10%, 20V	184-9086-460
C33	Capacitor, fixed, electrolytic, 0.1μF, 20%, 35V	184-7408-000
C34	Capacitor, fixed, electrolytic, 3.3μF, 20%, 50V	184-9087-530
C35	Capacitor, fixed, ceramic dielectric, 0.22μF, 20%, 50V	913-5019-800
C36	Capacitor, fixed, electrolytic, 1μF, 20%, 35V	184-7398-000
C37	Capacitor, fixed, electrolytic, 1μF, 20%, 35V	184-7398-000
C38	Capacitor, fixed, mica dielectric, 620pF, 2%, 100V	912-2093-050
C39	Capacitor, fixed, silvered mica, 160pF, 5%, 500V	912-3894-000
C40	Capacitor, fixed, mica dielectric, 10pF, ±0.5pF, 50V	912-4141-020
C41	Capacitor, fixed, mica dielectric, 22pF ±0.5pF, 50V	912-4141-030
C42	Capacitor, fixed, mica dielectric, 220pF, 5%, 500V	912-3903-001
C43	Capacitor, fixed, ceramic dielectric, 0.22μF, 20%, 50V	913-5019-800
CR1	Diode, 1N3064	353-3404-000
CR2	Diode, 1N3064	353-3404-000
CR3	Diode, 1N3064	353-3404-000
CR4	Diode, 1N3064	353-3404-000
CR5	Diode, 1N3064	353-3404-000
CR6	Diode, 1N3064	353-3404-000
CR7	Diode, 1N3064	353-3404-000
CR8	Diode, 1N3064	353-3404-000
CR9	Diode, 1N3064	353-3404-000
CR10	Diode, 1N3064	353-3404-000
CR11	Diode, 1N3064	353-3404-000
CR12	Diode, 1N3064	353-3404-000
CR13	Diode, 1N3064	353-3404-000
CR14	Diode, 1N3064	353-3404-000
J1	Jack, tip, white	360-0129-000
J2	Jack	360-0437-010
J3	Jack	360-0437-010
J4	Jack	360-0437-010
J5	Jack	360-0437-010
J6	Jack	360-0437-010
J7	Jack	360-0437-010
L1	Coil, 6800μH	240-0960-010
L2	Coil, 8200μH	240-2715-600
L3	Coil, 3900μH	240-2715-560
Q1	Transistor, 2N2484	352-0549-000
Q2	Transistor, 2N2484	352-0549-000
Q3	Transistor, 2N2484	352-0549-000
Q4	Transistor, 2N2484	352-0549-000
Q5	Transistor, 2N4092 (eff to REV AS)	352-0759-020
Q5	Transistor, 2N4091 (eff REV AS, SB 1)	352-0759-010
Q6	Transistor, 2N4092 (eff to REV AS)	352-0759-020
Q6	Transistor, 2N4091 (eff REV AS, SB 1)	352-0759-010
Q7	Transistor, 2N3823	352-0706-010
Q8	Transistor, 2N4092 (eff to REV AS)	352-0759-020
Q8	Transistor, 2N4091 (eff REV AS, SB 1)	352-0759-010
Q9	Transistor, 2N4092 (eff to REV AS)	352-0759-020
Q9	Transistor, 2N4091 (eff REV AS, SB 1)	352-0759-010
Q10	Transistor 2N3823	352-0706-010
Q11	Transistor, 2N4092 (eff to REV AS)	352-0759-020
Q11	Transistor, 2N4091 (eff REV AS, SB 1)	352-0759-010
Q12	Transistor, 2N4092 (eff to REV AS)	352-0759-020
Q12	Transistor, 2N4091 (eff REV AS, SB 1)	352-0759-010
Q13	Transistor, 2N3823	352-0706-010
Q14	Transistor, 2N2222A	352-0661-020
Q15	Transistor, 2N2222A	352-0661-020
Q16	Transistor, 2N2222A	352-0661-020
Q17	Transistor, 2N2222A	352-0661-020
Q18	Transistor, 2N2222A	352-0661-020
Q19	Transistor, 2N4092	352-0759-020
Q20	Transistor, 2N2222A	352-0661-020
Q21	Transistor, 2N2907A	352-0551-010
Q22	Transistor, 2N2907A	352-0551-010
Q23	Transistor, 2N2222A	352-0661-020
Q24	Transistor, 2N2222A	352-0661-020
Q25	Transistor, 2N2907A	352-0551-010
Q26	Transistor, 2N2222A	352-0661-020
Q27	Transistor, 2N2222A	352-0661-020
Q28	Transistor, 2N2222A	352-0661-020
Q29	Transistor, 2N2222A	352-0661-020
Q30	Transistor, 2N2222A	352-0661-020
Q31	Transistor, 2N2907A	352-0551-010
Q32	Transistor, 2N2222A	352-0661-020
Q33	Transistor, 2N2907A	352-0551-010
Q34	Transistor, 2N2907A	352-0551-010
Q35	Transistor, 2N2222A	352-0661-020
Q36	Transistor, 2N2222A	352-0661-020
Q37	Transistor, 2N2222A	352-0661-020
Q38	Transistor, 2N2222A	352-0661-020
Q39	Transistor, 2N2222A	352-0661-020
Q40	Transistor, 2N2222A	352-0661-020
R1	Resistor, fixed, film, 100Ω, 1%, 1/8W	705-0948-000
R2	Resistor, fixed, film, 100Ω, 1%, 1/8W	705-0948-000
R3	Resistor, fixed, film, 1kΩ, 1%, 1/8W	705-0996-000
R4	Resistor, fixed, film, 1kΩ, 1%, 1/8W	705-0996-000
R5	Resistor, fixed, composition, 100kΩ, 10%, 1/4W	745-0821-000
R6	Resistor, fixed, composition, 47kΩ, 10%, 1/4W	745-0809-000
R7	Resistor, fixed, film, 51.1kΩ, 1%, 1/8W	705-1078-000
R8	Resistor, fixed, film, 78.7kΩ, 1%, 1/8W	705-1087-000
R9	Resistor, fixed, film, 2610Ω, 1%, 1/8W	705-1016-000
R10	Resistor, fixed, composition, 5600Ω, 10%, 1/4W	745-0776-000
R11	Resistor, fixed, composition, 47kΩ, 10%, 1/4W	745-0809-000
R12	Resistor, fixed, composition, 2200Ω, 10%, 1/4W	745-0761-000
R13	Resistor, fixed, composition, 100kΩ, 10%, 1/4W	745-0821-000
R14	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R15	Resistor, fixed, film, 16.9kΩ, 1%, 1/8W	705-1055-000
R16	Resistor, fixed, composition, 1kΩ, 10%, 1/4W	745-0749-000
R17	Resistor, fixed, film, 8250Ω, 1%, 118W	705-1040-000
R18	Resistor, composition, 5600Ω, 10%, 1/4W	745-0776-000
R19	Resistor, film, 5110Ω, 1%, 1/8W	705-1030-000
R20	Resistor, fixed, composition, 220kΩ, 10%, 1/4W	745-0833-000
R21	Resistor, fixed, composition, 220kΩ, 10%, 1/4W	745-0833-000
R22	Resistor, fixed, film, 51.1kΩ, 1%, 1/8W	705-1078-000
R23	Resistor, fixed, film, 51.1kΩ, 1%, 1/8W	705-1078-000
R24	Resistor, fixed, film, 25.5kΩ, 1%, 1/8W	705-3605-670
R25	Resistor, fixed, composition, 47kΩ, 10%, 1/4W	745-0809-000
R26	Resistor, fixed, composition, 47kΩ, 10%, 1/4W	745-0809-000
R27	Resistor, fixed, composition, 4700Ω, 10%, 1/4W	745-0773-000
R28	Resistor, fixed, composition, 220kΩ, 10%, 1/4W	745-0833-000
R29	Resistor, fixed, composition, 220kΩ, 10%, 1/4W	745-0833-000
R30	Resistor, fixed, film, 51.1kΩ, 1%, 1/8W	705-1078-000
R31	Resistor, fixed, film, 51.1kΩ, 1%, 1/8W	705-1078-000
R32	Resistor, fixed, film, 25.5kΩ, 1%, 1/8W	705-3605-670
R33	Resistor, fixed, composition, 47kΩ, 10%, 1/4W	745-0809-000
R34	Resistor, fixed, composition, 47kΩ, 10%, 1/4W	745-0809-000
R35	Resistor, fixed, composition, 4700Ω, 10%, 1/4W	745-0773-000
R36	Resistor, fixed, composition, 220kΩ, 10%, 1/4W	745-0833-000
R37	Resistor, fixed, composition, 220kΩ, 10%, 1/4W	745-0833-000
R38	Resistor, fixed, film, 51.1kΩ, 1%, 1/8W	705-1078-000
R39	Resistor, fixed, film, 51.1kΩ, 1%, 1/8W	705-1078-000
R40	Resistor, fixed, film, 25.5kΩ, 1%, 1/8W	705-3605-670
R41	Resistor, fixed, composition, 47kΩ, 10%, 1/4W	745-0809-000
R42	Resistor, fixed, composition, 47kΩ, 10%, 1/4W	745-0809-000
R43	Resistor, fixed, composition, 4700Ω, 10%, 1/4W	745-0773-000
R44	Resistor, fixed, film, 562Ω, 1%, 118W	705-0984-000
R45	Resistor, fixed, film, 51.1kΩ, 1%, 1/8W	705-1078-000
R46	Resistor, fixed, composition, 4700Ω, 10%, 1/4W	745-0773-000
R47	Resistor, fixed, composition, 33kΩ, 10%, 1/4W	745-0803-000
R48	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R49	Resistor, fixed, composition, 5600Ω, 10%, 1/4W	745-0776-000
R50	Resistor, fixed, composition, 270Ω, 10%, 1/4W	745-0728-000
R51	Resistor, fixed, composition, 220Ω, 10%, 1/4W	745-0725-000
R52	Resistor, fixed, composition, 1kΩ, 10%, 1/4W	745-0749-000
R53	Resistor, fixed, composition, 4700Ω, 10%, 1/4W	745-0773-000
R54	Resistor, fixed, composition, 82kΩ, 10%, 1/4W	745-0818-000
R55	Resistor, fixed, composition, 5600Ω, 10%, 1/4W	745-0776-000
R56	Resistor, fixed, composition, 3300Ω, 10%, 1/4W	745-0767-000
R57	Resistor, fixed, composition, 220Ω, 10%, 1/4W	745-0725-000
R58	Resistor, fixed, composition, 56kΩ, 10%, 1/4W	745-0812-000
R59	Resistor, fixed, composition, 4700Ω, 10%, 1/4W	745-0773-000
R60	Resistor, fixed, composition, 2200Ω, 10%, 1/4W	745-0761-000
R61	Resistor, fixed, composition, 180Ω, 10%, 1/4W	745-0722-000
R62	Resistor, fixed, composition, 3300Ω, 10%, 1/4W	745-0767-000
R63	Resistor, fixed, composition, 470Ω, 10%, 1/4W	745-0737-000
R64	Resistor, fixed, composition, 100kΩ, 10%, 1/4W	745-0821-000
R65	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R66	Resistor, fixed, composition, 100kΩ, 10%, 1/4W	745-0821-000
R67	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R68	Resistor, fixed composition, 47kΩ, 10%, 1/4W	745-0809-000
R69	Resistor, fixed, composition, 4700Ω, 10%, 1/4W	745-0773-000
R70	Resistor, fixed, film, 56.2kΩ, 1%, 1/8W	705-1085-000
R71	Resistor, fixed, film, 3160Ω, 1%, 1/8W	705-1020-000
R72	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R73	Resistor, fixed, composition, 33kΩ, 10%, 1/4W	745-0803-000
R74	Resistor, fixed, film, 18.2kΩ, 1%, 1/8W	705-3605-600
R75	Resistor, fixed, film, 178kΩ, 1%, 1/8W	705-1104-000
R76	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000


TER
A1
Q11
2N4091
+13.4
+22 VDC
R39
51.1K
R38
51.1K
Q13
2N3823
Q12
2N4091
R40
25.5K
+13.5
C13
100 PF
R43
4700
R44
562
L1
6800
C14
390
PF
R45
51.1K
+13.8
C32
10
CR11
1N3064
CR10
1N3064
ZERO CROSSING DETECTOR
+22 VDC
POST
AMPL
J4
C33
0.1
R99
1MEG
Q30
2N22
22A
R100
10K
R101
6800
Q31
2N2907
A
Q38
2N2222A
R102
39K
-15 VDC
R103
1 MEG
R104
22K
ZERO
CROSSING
DET
J5
R140
4700
C40
10 PF
C41
22 PF
P/O
P1
11 FILTERED IF SIG
Q40
2N2222A
+9.8
R141
2200
PRESENCE DETECTOR
C
IG PRES
ET THRESHOLD
DJ
R107
33K
112
70
+21.3
Q33
2N2907
A
SIG
PRES
J6
+15.7
Q32
2N2222A
Q39
2N22
22A
R105
78.7K
R108
39K
-15 VDC
R106
27.4K
R109
68K
CR12
1N3064
SIG PRES
ENABLE
J7
R69
4700
+21.9
P/O
P1
28 SIG PRESENCE ENBL
P/O
P1
3
5
9
13
17
19
21
23
25
RESERVED
A2 P1 CONN
2 ● ☐ 1
4 ☐ ☐ 3
6 ☐ ☐ 5
8 ☐ ☐ 7
10 ☐ ☐ 9
12 ☐ ☐ 11
14 ☐ ☐ 13
16 ■ ☐ 15
18 ☐ ☐ 17
20 ☐ ☐ 19
22 ☐ ☐ 21
24 ☐ ☐ 23
26 ☐ ☐ 25
28 ☐ ☐ 27
30 ☐ ● 29
A2 P2 CONN
2 ○ ☐ 1
4 ☐ ☐ 3
6 ☐ ☐ 5
8 ■ ☐ 7
10 ☐ ☐ 9
12 ☐ ○ 11
GA0-0352-064-0
637-2031

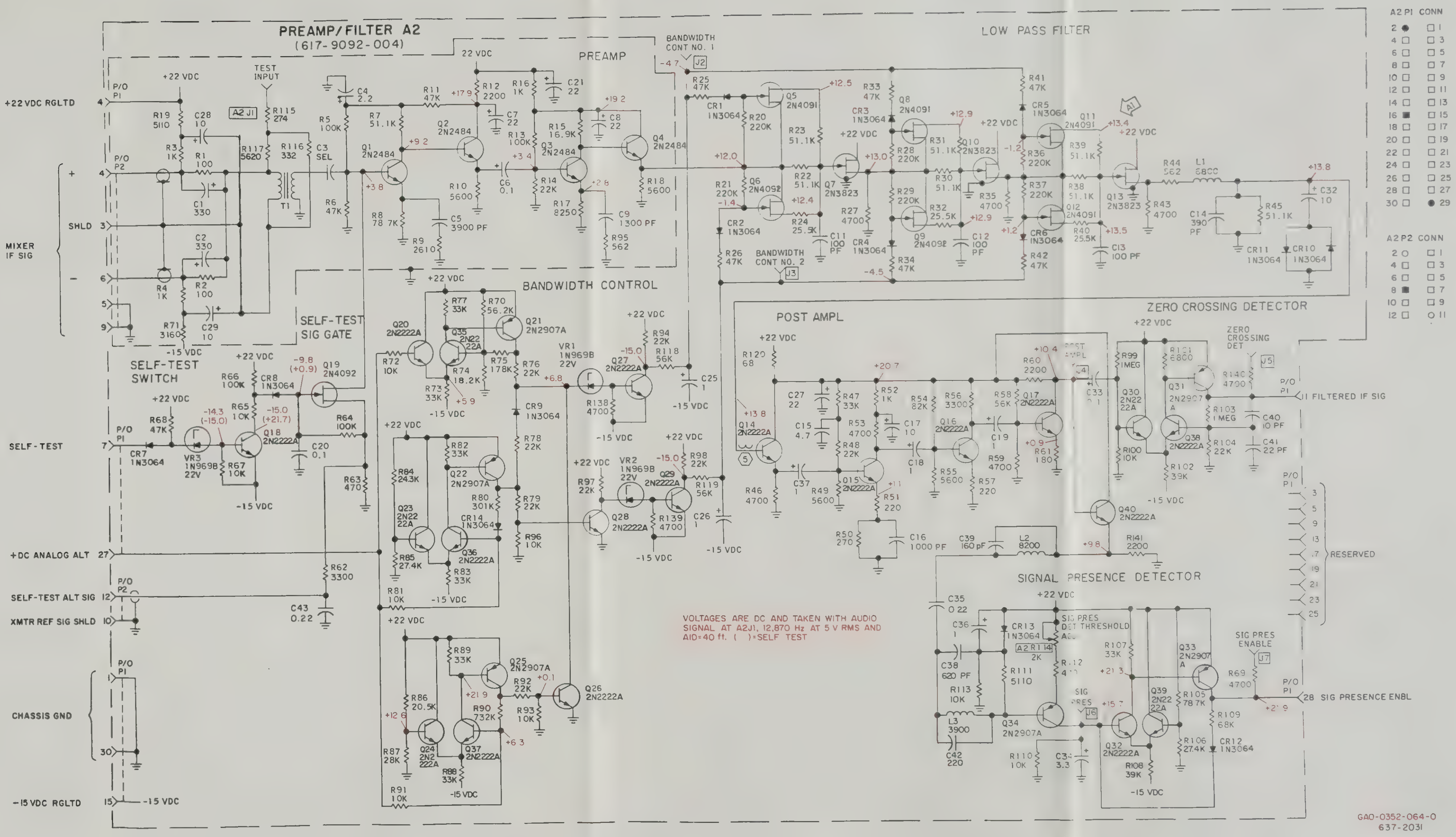
Preamplifier/Filter A2, Schematic Diagram
Figure 6-14

PARTS LIST
PREAMP/FILTER CIRCUIT CARD ASSEMBLY A2 (PART NUMBER 617-9092-004)
LATEST EFFECTIVITY: REV AW

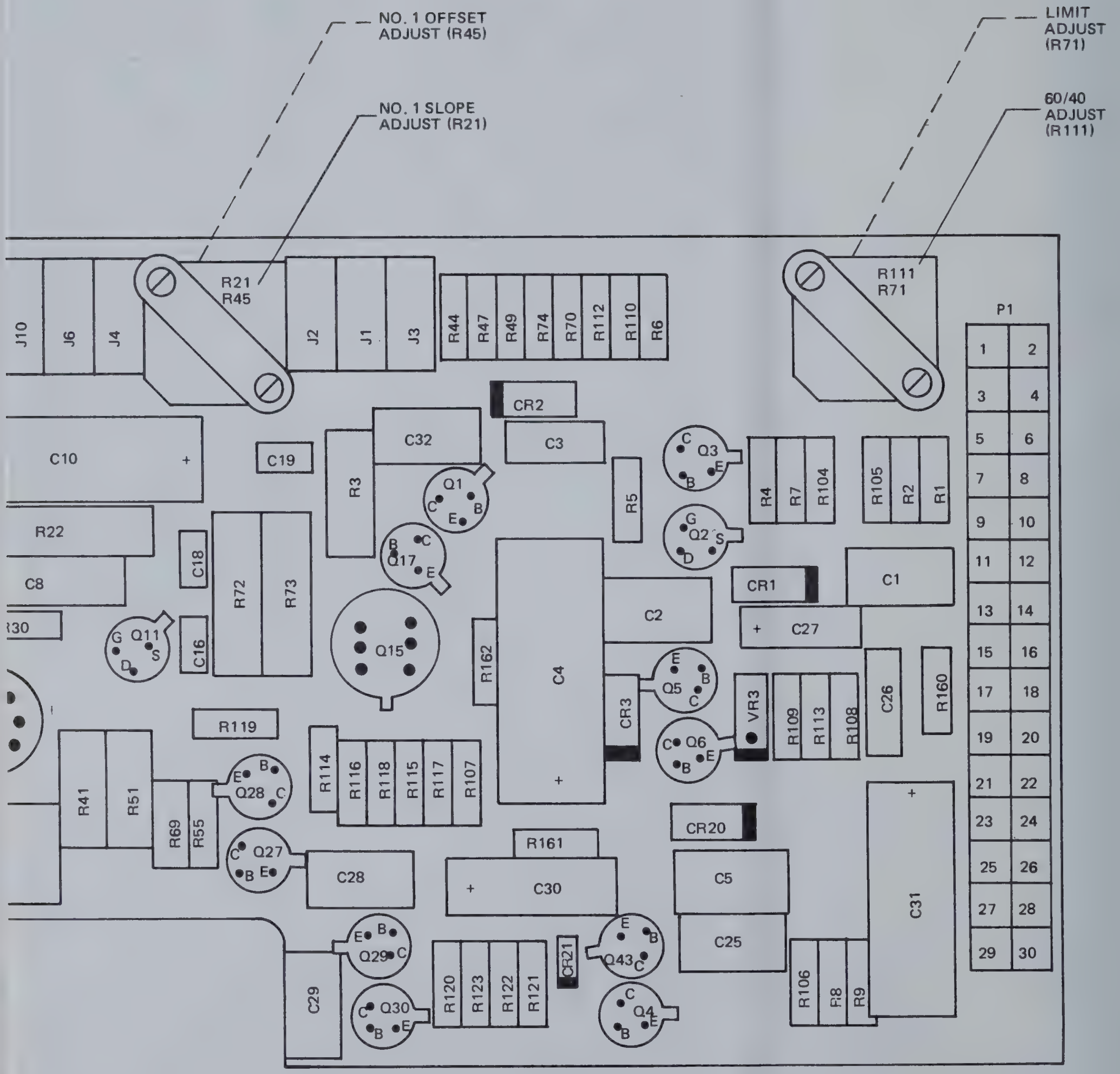
SYMBOL	DESCRIPTION	PART NUMBER
C1	Capacitor, fixed, electrolytic, 330μF, 20%, 6V	184-7647-000
C2	Capacitor, fixed, electrolytic, 330μF, 20%, 6V	184-7647-000
C3	Capacitor, fixed, mica dielectric, 470pF, 5%, 100V	912-2093-160
C3	Capacitor, fixed, mica dielectric, 510pF, 5%, 100V	912-2093-170
C3	Capacitor, fixed, mica dielectric, 560pF, 5%, 100V	912-2093-180
C3	Capacitor, fixed, mica dielectric, 620pF, 5%, 100V	912-2093-190
C3	Capacitor, fixed, mica dielectric, 680pF, 5%, 500V	912-2093-200
C3	Capacitor, fixed, mica dielectric, 750pF, 5%, 100V	912-2093-210
C3	Capacitor, fixed, mica dielectric, 820pF, 5%, 100V	912-2093-220
C3	Capacitor, fixed, mica dielectric, 910pF, 5%, 100V	912-2093-230
C3	Capacitor, fixed, mica dielectric, 1000pF, 5%, 100V	912-2093-240
C3	Capacitor, fixed, mica dielectric, 1100pF, 5%, 100V	912-2093-250
C3	Capacitor, fixed, mica dielectric, 1200pF, 5%, 100V	912-2093-260
C4	Capacitor, fixed, electrolytic, 2.2μF, 20%, 35V	184-7397-000
C5	Capacitor, fixed, mica dielectric, 3900pF, 5%, 500V	912-3046-000
C6	Capacitor, fixed, electrolytic, 0.1μF, 20%, 35V	184-7408-000
C7	Capacitor, fixed, electrolytic, 22μF, 20%, 35V	184-9086-670
C8	Capacitor, fixed, electrolytic, 22μF, 20%, 35V	184-9086-670
C9	Capacitor, fixed, mica dielectric, 1300pF, 5%, 500V	912-3010-000
C10	Not used	
C11	Capacitor, fixed, mica dielectric, 100pF, 5%, 50V	912-4141-050
C12	Capacitor, fixed, mica dielectric, 100pF, 5%, 50V	912-4141-050
C13	Capacitor, fixed, mica dielectric, 100pF, 5%, 50V	912-4141-050
C14	Capacitor, fixed, mica dielectric, 390pF, 5%, 500V	912-2858-000
C15	Capacitor, fixed, electrolytic, 4.7μF, 20%, 35V	184-7396-001
C16	Capacitor, fixed, mica dielectric, 1000pF, 5%, 500V	912-3001-000
C17	Capacitor, fixed, electrolytic, 10μF, 10%, 50V	184-9087-610
C18	Capacitor, fixed, electrolytic, 1μF, 20%, 35V	184-7398-000
C19	Capacitor, fixed, electrolytic, 1μF, 20%, 35V	184-7398-000
C20	Capacitor, fixed, ceramic dielectric, 0.1μF, 10%, 50V	913-5019-320
C21	Capacitor, fixed, electrolytic, 22μF, 20%, 35V	184-9086-670
C22-C24	Not used	
C25	Capacitor, fixed, electrolytic, 1μF, 20%, 50V	184-9087-440
C26	Capacitor, fixed, electrolytic, 1μF, 20%, 50V	184-9087-440
C27	Capacitor, fixed, electrolytic, 22μF, 20%, 35V	184-9086-670
C28	Capacitor, fixed, electrolytic, 10μF, 20%, 20V	184-7375-000
C29	Capacitor, fixed, electrolytic, 10μF, 20%, 20V	184-7375-000
C30-C31	Not used	
C32	Capacitor, fixed, electrolytic, 10μF, 10%, 20V	184-9086-460
C33	Capacitor, fixed, electrolytic, 0.1μF, 20%, 35V	184-7408-000
C34	Capacitor, fixed, electrolytic, 3.3μF, 20%, 50V	184-9087-530
C35	Capacitor, fixed, ceramic dielectric, 0.22μF, 20%, 50V	913-5019-800
C36	Capacitor, fixed, electrolytic, 1μF, 20%, 35V	184-7398-000
C37	Capacitor, fixed, electrolytic, 1μF, 20%, 35V	184-7398-000
C38	Capacitor, fixed, mica dielectric, 620pF, 2%, 100V	912-2093-050
C39	Capacitor, fixed, silvered mica, 160pF, 5%, 500V	912-3894-000
C40	Capacitor, fixed, mica dielectric, 10pF, ±0.5pF, 50V	912-4141-020
C41	Capacitor, fixed, mica dielectric, 22pF ±0.5pF, 50V	912-4141-030
C42	Capacitor, fixed, mica dielectric, 220pF, 5%, 500V	912-3903-001
C43	Capacitor, fixed, ceramic dielectric, 0.22μF, 20%, 50V	913-5019-800
CR1	Diode, 1N3064	353-3404-000
CR2	Diode, 1N3064	353-3404-000
CR3	Diode, 1N3064	353-3404-000
CR4	Diode, 1N3064	353-3404-000
CR5	Diode, 1N3064	353-3404-000
CR6	Diode, 1N3064	353-3404-000
CR7	Diode, 1N3064	353-3404-000
CR8	Diode, 1N3064	353-3404-000
CR9	Diode, 1N3064	353-3404-000
CR10	Diode, 1N3064	353-3404-000
CR11	Diode, 1N3064	353-3404-000
CR12	Diode, 1N3064	353-3404-000
CR13	Diode, 1N3064	353-3404-000
CR14	Diode, 1N3064	353-3404-000
J1	Jack, tip, white	360-0129-000
J2	Jack	360-0437-010
J3	Jack	360-0437-010
J4	Jack	360-0437-010
J5	Jack	360-0437-010
J6	Jack	360-0437-010
J7	Jack	360-0437-010
L1	Coil, 6800μH	240-0960-010
L2	Coil, 8200μH	240-2715-600
L3	Coil, 3900μH	240-2715-560
Q1	Transistor, 2N2484	352-0549-000
Q2	Transistor, 2N2484	352-0549-000
Q3	Transistor, 2N2484	352-0549-000
Q4	Transistor, 2N2484	352-0549-000
Q5	Transistor, 2N4092 (eff to REV AS)	352-0759-020
Q5	Transistor, 2N4091 (eff REV AS, SB 1)	352-0759-010
Q6	Transistor, 2N4092 (eff to REV AS)	352-0759-020
Q6	Transistor, 2N4091 (eff REV AS, SB 1)	352-0759-010
Q7	Transistor, 2N3823	352-0706-010
Q8	Transistor, 2N4092 (eff to REV AS)	352-0759-020
Q8	Transistor, 2N4091 (eff REV AS, SB 1)	352-0759-010
Q9	Transistor, 2N4092 (eff to REV AS)	352-0759-020
Q9	Transistor, 2N4091 (eff REV AS, SB 1)	352-0759-010
Q10	Transistor 2N3823	352-0706-010
Q11	Transistor, 2N4092 (eff to REV AS)	352-0759-020
Q11	Transistor, 2N4091 (eff REV AS, SB 1)	352-0759-010
Q12	Transistor, 2N4092 (eff to REV AS)	352-0759-020
Q12	Transistor, 2N4091 (eff REV AS, SB 1)	352-0759-010
Q13	Transistor, 2N3823	352-0706-010
Q14	Transistor, 2N2222A	352-0661-020
Q15	Transistor, 2N2222A	352-0661-020
Q16	Transistor, 2N2222A	352-0661-020
Q17	Transistor, 2N2222A	352-0661-020
Q18	Transistor, 2N2222A	352-0661-020
Q19	Transistor, 2N4092	352-0759-020
Q20	Transistor, 2N2222A	352-0661-020
Q21	Transistor, 2N2907A	352-0551-010
Q22	Transistor, 2N2907A	352-0551-010
Q23	Transistor, 2N2222A	352-0661-020
Q24	Transistor, 2N2222A	352-0661-020
Q25	Transistor, 2N2907A	352-0551-010
Q26	Transistor, 2N2222A	352-0661-020
Q27	Transistor, 2N2222A	352-0661-020
Q28	Transistor, 2N2222A	352-0661-020
Q29	Transistor, 2N2222A	352-0661-020
Q30	Transistor, 2N2222A	352-0661-020
Q31	Transistor, 2N2907A	352-0551-010
Q32	Transistor, 2N2222A	352-0661-020
Q33	Transistor, 2N2907A	352-0551-010
Q34	Transistor, 2N2907A	352-0551-010
Q35	Transistor, 2N2222A	352-0661-020
Q36	Transistor, 2N2222A	352-0661-020
Q37	Transistor, 2N2222A	352-0661-020
Q38	Transistor, 2N2222A	352-0661-020
Q39	Transistor, 2N2222A	352-0661-020
Q40	Transistor, 2N2222A	352-0661-020
R1	Resistor, fixed, film, 100Ω, 1%, 1/8W	705-0948-000
R2	Resistor, fixed, film, 100Ω, 1%, 1/8W	705-0948-000
R3	Resistor, fixed, film, 1kΩ, 1%, 1/8W	705-0996-000
R4	Resistor, fixed, film, 1kΩ, 1%, 1/8W	705-0996-000
R5	Resistor, fixed, composition, 100kΩ, 10%, 1/4W	745-0821-000
R6	Resistor, fixed, composition, 47kΩ, 10%, 1/4W	745-0809-000
R7	Resistor, fixed, film, 51.1kΩ, 1%, 1/8W	705-1078-000
R8	Resistor, fixed, film, 78.7kΩ, 1%, 1/8W	705-1087-000
R9	Resistor, fixed, film, 2610Ω, 1%, 1/8W	705-1016-000
R10	Resistor, fixed, composition, 5600Ω, 10%, 1/4W	745-0776-000
R11	Resistor, fixed, composition, 47kΩ, 10%, 1/4W	745-0809-000
R12	Resistor, fixed, composition, 2200Ω, 10%, 1/4W	745-0761-000
R13	Resistor, fixed, composition, 100kΩ, 10%, 1/4W	745-0821-000
R14	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R15	Resistor, fixed, film, 16.9kΩ, 1%, 1/8W	705-1055-000
R16	Resistor, fixed, composition, 1kΩ, 10%, 1/4W	745-0749-000
R17	Resistor, fixed, film, 8250Ω, 1%, 118W	705-1040-000
R18	Resistor, composition, 5600Ω, 10%, 1/4W	745-0776-000
R19	Resistor, film, 5110Ω, 1%, 1/8W	705-1030-000
R20	Resistor, fixed, composition, 220kΩ, 10%, 1/4W	745-0833-000
R21	Resistor, fixed, composition, 220kΩ, 10%, 1/4W	745-0833-000
R22	Resistor, fixed, film, 51.1kΩ, 1%, 1/8W	705-1078-000
R23	Resistor, fixed, film, 51.1kΩ, 1%, 1/8W	705-1078-000
R24	Resistor, fixed, film, 25.5kΩ, 1%, 1/8W	705-3605-670
R25	Resistor, fixed, composition, 47kΩ, 10%, 1/4W	745-0809-000
R26	Resistor, fixed, composition, 47kΩ, 10%, 1/4W	745-0809-000
R27	Resistor, fixed, composition, 4700Ω, 10%, 1/4W	745-0773-000
R28	Resistor, fixed, composition, 220kΩ, 10%, 1/4W	745-0833-000
R29	Resistor, fixed, composition, 220kΩ, 10%, 1/4W	745-0833-000
R30	Resistor, fixed, film, 51.1kΩ, 1%, 1/8W	705-1078-000
R31	Resistor, fixed, film, 51.1kΩ, 1%, 1/8W	705-1078-000
R32	Resistor, fixed, film, 25.5kΩ, 1%, 1/8W	705-3605-670
R33	Resistor, fixed, composition, 47kΩ, 10%, 1/4W	745-0809-000
R34	Resistor, fixed, composition, 47kΩ, 10%, 1/4W	745-0809-000
R35	Resistor, fixed, composition, 4700Ω, 10%, 1/4W	745-0773-000
R36	Resistor, fixed, composition, 220kΩ, 10%, 1/4W	745-0833-000
R37	Resistor, fixed, composition, 220kΩ, 10%, 1/4W	745-0833-000
R38	Resistor, fixed, film, 51.1kΩ, 1%, 1/8W	705-1078-000
R39	Resistor, fixed, film, 51.1kΩ, 1%, 1/8W	705-1078-000
R40	Resistor, fixed, film, 25.5kΩ, 1%, 1/8W	705-3605-670
R41	Resistor, fixed, composition, 47kΩ, 10%, 1/4W	745-0809-000
R42	Resistor, fixed, composition, 47kΩ, 10%, 1/4W	745-0809-000
R43	Resistor, fixed, composition, 4700Ω, 10%, 1/4W	745-0773-000
R44	Resistor, fixed, film, 562Ω, 1%, 118W	705-0984-000
R45	Resistor, fixed, film, 51.1kΩ, 1%, 1/8W	705-1078-000
R46	Resistor, fixed, composition, 4700Ω, 10%, 1/4W	745-0773-000
R47	Resistor, fixed, composition, 33kΩ, 10%, 1/4W	745-0803-000
R48	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R49	Resistor, fixed, composition, 5600Ω, 10%, 1/4W	745-0776-000
R50	Resistor, fixed, composition, 270Ω, 10%, 1/4W	745-0728-000
R51	Resistor, fixed, composition, 220Ω, 10%, 1/4W	745-0725-000
R52	Resistor, fixed, composition, 1kΩ, 10%, 1/4W	745-0749-000
R53	Resistor, fixed, composition, 4700Ω, 10%, 1/4W	745-0773-000
R54	Resistor, fixed, composition, 82kΩ, 10%, 1/4W	745-0818-000
R55	Resistor, fixed, composition, 5600Ω, 10%, 1/4W	745-0776-000
R56	Resistor, fixed, composition, 3300Ω, 10%, 1/4W	745-0767-000
R57	Resistor, fixed, composition, 220Ω, 10%, 1/4W	745-0725-000
R58	Resistor, fixed, composition, 56kΩ, 10%, 1/4W	745-0812-000
R59	Resistor, fixed, composition, 4700Ω, 10%, 1/4W	745-0773-000
R60	Resistor, fixed, composition, 2200Ω, 10%, 1/4W	745-0761-000
R61	Resistor, fixed, composition, 180Ω, 10%, 1/4W	745-0722-000
R62	Resistor, fixed, composition, 3300Ω, 10%, 1/4W	745-0767-000
R63	Resistor, fixed, composition, 470Ω, 10%, 1/4W	745-0737-000
R64	Resistor, fixed, composition, 100kΩ, 10%, 1/4W	745-0821-000
R65	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R66	Resistor, fixed, composition, 100kΩ, 10%, 1/4W	745-0821-000
R67	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R68	Resistor, fixed composition, 47kΩ, 10%, 1/4W	745-0809-000
R69	Resistor, fixed, composition, 4700Ω, 10%, 1/4W	745-0773-000
R70	Resistor, fixed, film, 56.2kΩ, 1%, 1/8W	705-1085-000
R71	Resistor, fixed, film, 3160Ω, 1%, 1/8W	705-1020-000
R72	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R73	Resistor, fixed, composition, 33kΩ, 10%, 1/4W	745-0803-000
R74	Resistor, fixed, film, 18.2kΩ, 1%, 1/8W	705-3605-600
R75	Resistor, fixed, film, 178kΩ, 1%, 1/8W	705-1104-000
R76	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000

PARTS LIST
PREAMP/FILTER CIRCUIT CARD ASSEMBLY A2 (PART NUMBER 617-9092-004)

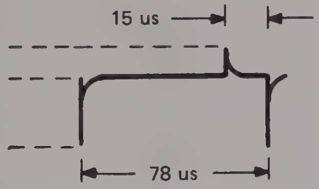
SYMBOL	DESCRIPTION	PART NUMBER
R77	Resistor, fixed, composition, 33kΩ, 10%, 1/4W	745-0803-000
R78	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R79	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R80	Resistor, fixed, film, 301kΩ, 1%, 1/8W	705-1115-000
R81	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R82	Resistor, fixed, composition, 33kΩ, 10%, 1/4W	745-0803-000
R83	Resistor, fixed, composition, 33kΩ, 10%, 1/4W	745-0803-000
R84	Resistor, fixed, film, 24.3kΩ, 1%, 1/8W	705-3605-660
R85	Resistor, fixed, film, 27.4kΩ, 1%, 1/8W	705-1065-000
R86	Resistor, fixed, film, 20.5kΩ, 1%, 1/8W	705-1059-000
R87	Resistor, fixed, film, 28kΩ, 1%, 118W	705-3605-690
R88	Resistor, fixed, composition, 33kΩ, 10%, 1/4W	745-0803-000
R89	Resistor, fixed, composition, 33kΩ, 10%, 1/4W	745-0803-000
R90	Resistor, fixed, film, 732kΩ, 1%, 1/4W	705-3601-400
R91	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R92	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R93	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R94	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R95	Resistor, fixed, film, 562Ω, 1%, 1/8W	705-0984-000
R96	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R97	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R98	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R99	Resistor, fixed, composition, 1MΩ, 10%, 1/4W	745-0857-000
R100	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R101	Resistor, fixed, composition, 6800Ω, 10%, 1/4W	745-0779-000
R102	Resistor, fixed, composition, 39kΩ, 10%, 1/4W	745-0806-000
R103	Resistor, fixed, composition, 1MΩ, 10%, 1/4W	745-0857-000
R104	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R105	Resistor, fixed, film, 78.7kΩ, 1%, 1/8W	705-1087-000
R106	Resistor, fixed, film, 27.4kΩ, 1%, 1/8W	705-1065-000
R107	Resistor, fixed, composition, 33kΩ, 10%, 1/4W	745-0803-000
R108	Resistor, fixed, composition, 39kΩ, 10%, 1/4W	745-0806-000
R109	Resistor, fixed, composition, 68kΩ, 10%, 1/4W	745-0815-000
R110	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R111	Resistor, fixed, film, 5110Ω, 1%, 1/8W	705-1030-000
R112	Resistor, fixed, composition, 470Ω, 10%, 1/4W	745-0737-000
R113	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R114	Resistor, variable, wire-wound, 2kΩ, 5%, 3/4W	381-1721-110
R115	Resistor, fixed, film, 274Ω, 1%, 1/8W	705-0969-000
R116	Resistor, fixed, film, 332Ω, 1%, 1/8W	705-0973-000
R117	Resistor, fixed, film, 5620Ω, 1%, 1/8W	705-1032-000
R118	Resistor, fixed, composition, 56kΩ, 10%, 1/4W	745-0812-000
R119	Resistor, fixed, composition, 56kΩ, 10%, 1/4W	745-0812-000
R120	Resistor, fixed, composition, 68Ω, 10%, 1/4W	745-0707-000
R121- R137	Not used	
R138	Resistor, fixed, composition, 4700Ω, 10%, 114W	745-0773-000
R139	Resistor, fixed, composition, 4700Ω, 10%, 114W	745-0773-000
R140	Resistor, fixed, composition, 4700Ω, 10%, 1/4W	745-0773-000
R141	Resistor, fixed, composition, 2200Ω, 10%, 1/4W	745-0761-000
T1	Transformer, AF	667-0240-010
VR1	Zener diode, 1N969B, 22V	353-3180-000
VR2	Zener diode, 1N969B, 22V	353-3180-000
VR3	Zener diode, 1N969B, 22V	353-3180-000
Label	Label (Eff REV AY)	280-2745-040


PREAMP/FILTER A2
(617-9092-004)
PREAMP
LOW PASS FILTER
BANDWIDTH CONTROL
SELF-TEST SIG GATE
SELF-TEST SWITCH
POST AMPL
ZERO CROSSING DETECTOR
SIGNAL PRESENCE DETECTOR
+22 VDC RGLTD
MIXER IF SIG
SHLD
SELF-TEST
+DC ANALOG ALT
SELF-TEST ALT SIG
XMTR REF SIG SHLD
CHASSIS GND
-15 VDC RGLTD
TEST INPUT
BANDWIDTH CONT NO. 1
BANDWIDTH CONT NO. 2
ZERO CROSSING DET
SIG PRES ENABLE
FILTERED IF SIG
SIG PRESENCE ENBL
RESERVED
A2 P1 CONN
A2 P2 CONN
VOLTAGES ARE DC AND TAKEN WITH AUDIO SIGNAL AT A2J1, 12,870 Hz AT 5 V RMS AND AID=40 ft. ( )=SELF TEST
GA0-0352-064-0
637-2031

Preamplifier/Filter A2, Schematic Diagram
Figure 6-14

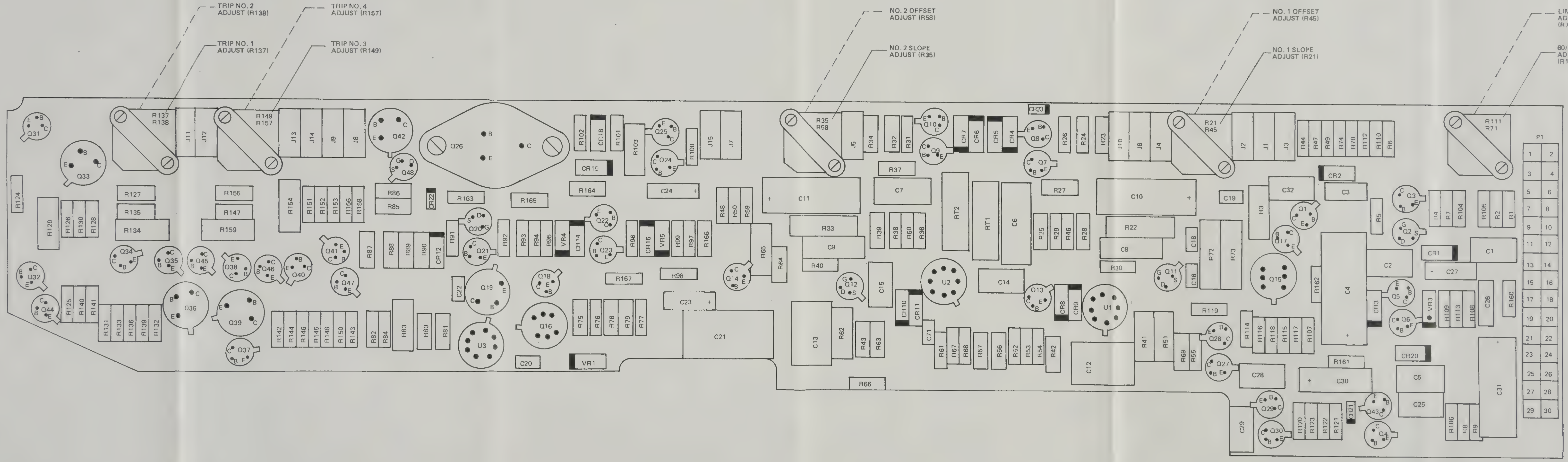

NO. 1 OFFSET ADJUST (R45)
NO. 1 SLOPE ADJUST (R21)
LIMIT ADJUST (R71)
60/40 ADJUST (R111)
R21
R45
R111
R71
P1
J10
J6
J4
J2
J1
J3
R44
R47
R49
R74
R70
R112
R110
R6
CR2
C10
C19
C32
C3
R3
Q1
Q3
R4
R7
R104
R105
R2
R1
R5
Q2
R22
Q17
C8
C18
R72
R73
C4
CR1
C1
C2
C27
Q11
C16
Q15
R162
Q5
VR3
R109
R113
R108
C26
R160
CR3
Q6
R119
R114
R116
R118
R115
R117
R107
R41
R51
Q28
R69
R55
CR20
C31
R161
Q27
C28
C30
C5
C25
Q29
C29
Q30
R120
R123
R122
R121
CR21
Q43
Q4
R106
R8
R9
TP4-7654-014

Altitude Processor A1, Component Location Diagram
Figure 6-15

TEST POINT	TYPICAL WAVEFORM OR NOMINAL VOLTAGE	TEST POINT	TYPICAL WAVEFORM OR NOMINAL VOLTAGE
INPUT: AUDIO SIG AT A2J1—12,870 Hz, 5 V RMS OUT OF AUDIO SIG GEN TO TEST FIXTURE INPUT. AID = 40 FT.			
	P/O ALT PROCESSOR A1		P/O ALT PROCESSOR A1
Q29C	+21.94 V DC	Q48-S	+28.6 mV
Q30B	+3.78 V DC	Q48-G	NORM— +21.78 V DC SELF-TEST— −0.021 V DC
Q43C	+6.3 V DC (INDICATION VARIES WITH METER USED)		
U1-2	+100 mV +20 mV −200 mV 		
U1-3	00.0 V DC		
U1-6	+5.46 V DC		
U2-3	0.0 V DC		
U2-6	+0.96 V DC		
U3-2	+3.2 VDC		
U3-3	+3.2 V DC		
U3-6	+7.1 V DC		

TP4-8444-013

Altitude Processor A1, Voltages and Waveforms
Figure 6-16


TRIP NO. 2 ADJUST (R138)

TRIP NO. 1 ADJUST (R137)

TRIP NO. 4 ADJUST (R157)

TRIP NO. 3 ADJUST (R149)

NO. 2 OFFSET ADJUST (R58)

NO. 2 SLOPE ADJUST (R35)

NO. 1 OFFSET ADJUST (R45)

NO. 1 SLOPE ADJUST (R21)

LIMIT ADJUST (R71)

60/40 ADJUST (R111)

Q31
Q33
R124
R129
R126
R130
R128
R137
R138
R127
R135
R134
Q34
Q35
Q45
Q32
Q44
R125
R140
R141
R131
R133
R136
R139
R132
Q36
Q38
Q46
Q40
Q39
Q37
J11
J12
R149
R157
R155
R147
R159
J13
J14
J9
J8
R154
R151
R152
R153
R156
R158
Q41
Q47
R142
R144
R146
R145
R148
R150
R143
R82
R84
R83
R80
R81
Q42
Q48
R86
R85
CR22
R87
R88
R89
R90
CR12
Q26
R163
R91
Q20
Q21
R92
C22
Q19
U3
R165
R93
R94
R95
VR4
CR14
Q18
Q16
C20
VR1
R102
CR18
R101
R103
Q25
Q24
CR19
R164
Q22
Q23
R96
CR16
VR5
R99
R97
R166
R167
R98
R75
R76
R78
R79
R77
R100
J15
J7
C24
C23
C21
R48
R50
R59
R65
R64
Q14
R35
R58
J5
R34
C11
R33
C9
R40
Q12
C15
C13
R62
R43
R63
R32
R31
R37
C7
R39
R38
R60
R36
Q10
Q9
CR7
CR6
CR5
CR4
Q8
Q7
U2
CR10
CR11
C71
R61
R67
R68
R57
R56
R52
R53
R54
R42
RT2
RT1
C6
C14
Q13
CR8
CR9
U1
CR23
R26
R24
R23
R27
R25
R29
R46
R28
J10
J6
J4
C10
R22
C8
R30
Q11
C18
C16
C12
R41
R51
R69
R55
Q28
Q27
C28
R21
R45
J2
J1
J3
C19
R72
R73
R119
R44
R47
R49
R74
R70
R112
R110
R6
CR2
C32
C3
R3
Q1
Q17
Q15
R162
C4
R114
R116
R118
R115
R117
R107
R161
C30
C29
Q29
Q30
R120
R123
R122
R121
CR21
Q43
Q4
Q3
Q2
R4
R7
R104
R5
R105
R2
R1
CR1
C1
C2
C27
Q5
Q6
CR3
VR3
R109
R113
R108
C26
R160
CR20
C5
C25
R106
R8
R9
C31
R111
R71
P1
R66
E
B
C
S
D
G
1
2
3
4
5
6
7
8
9
10
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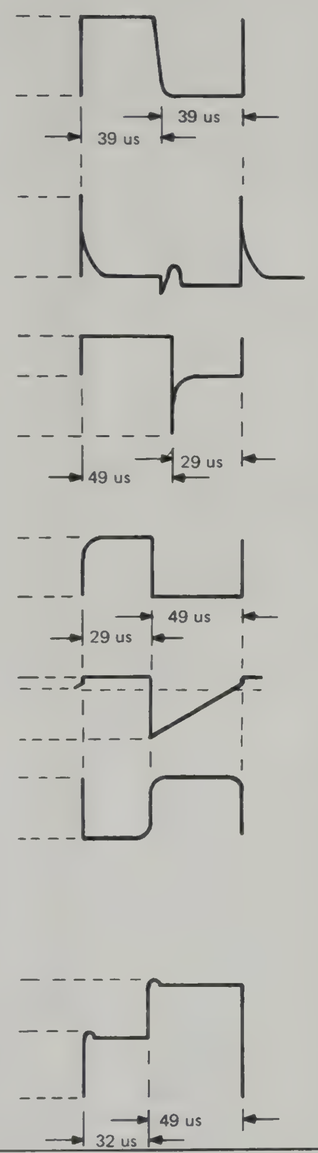
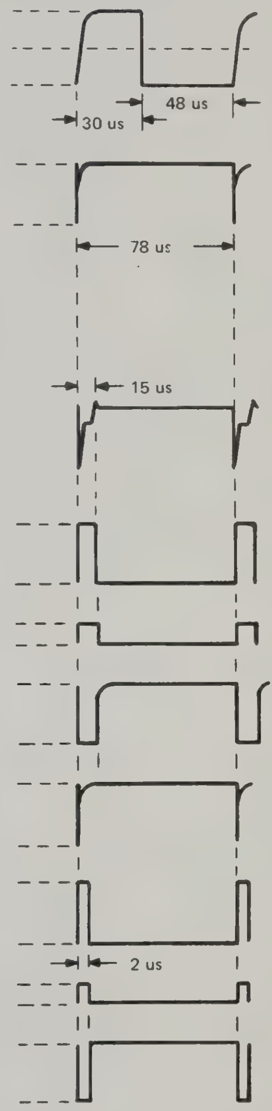
Altitude Processor A1, Component Location Diagram
Figure 6-15

INPUT: AUDIO SIG AT A2J1–12,870 Hz, 5 V RMS OUT OF AUDIO SIG GEN TO TEST FIXTURE INPUT. AID = 40 FT.

TEST POINT	TYPICAL WAVEFORM OR NOMINAL VOLTAGE
	P/O ALT PROCESSOR A1
P1-11	22 V 0 V
CR1-C	12 V 0 V
Q1-B	0.8V 0.2V –1.8V
Q1-C J1	20 V 0 V
Q2-G	0.8V 0V –20V
Q2-D	10 V 0 V
Q3-B	+18.34 V DC
Q3-E	+18.89 V DC
Q4-B	+0.3 V –0.3 V –0.9 V

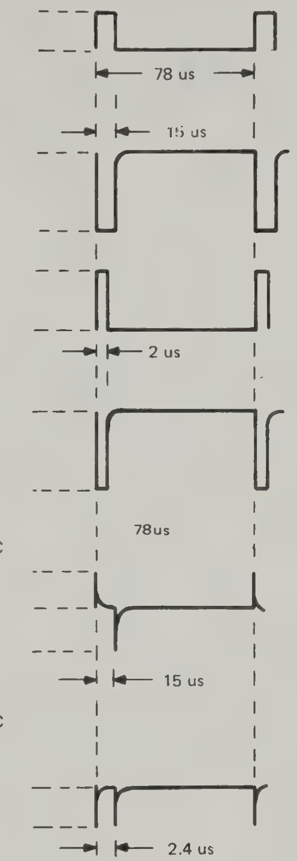


TEST POINT	TYPICAL WAVEFORM OR NOMINAL VOLTAGE
	P/O ALT PROCESSOR A1
Q4-C	+16.0 V 0.1V
J3	+1.0 V –5.5 V
Q5-B	+5.68 V DC
Q5-E	+5.08 V DC
Q5-C	+18.27 V DC
Q6-B	+5.69 V DC
Q7-B	+0.9 V 0 V –3.0 V
Q7-C J4	12V 0V
Q8-B	0.8V 0.1V
Q8-C	12 V 0 V
Q9-B	+0.8 V –4.4 V
Q9-C J5	12 V 0 V
Q10-B	0.8 V 100 mV
Q10-C	12 V 0 V

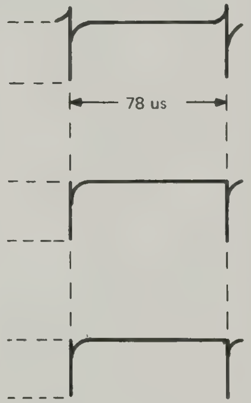


INPUT: AUDIO SIG AT A2J1-12,870 Hz, 5 V RMS OUT OF AUDIO SIG GEN TO TEST FIXTURE INPUT. AID = 40 FT.

TEST POINT	TYPICAL WAVEFORM OR NOMINAL VOLTAGES
	P/O ALT PROCESSOR A1
Q11-G	–14 V –24 V
Q11-D	+1.0V –15V
Q12-G	–14V –24V
Q12-D	+1.0 V –15 V
Q13-B	+0.02 V DC
Q13-E	+120 mV 0.0 V –360 mV
Q13-C	+5.43 V DC
Q14-B	0.0 V DC
Q14-E	0.0 V –0.07 V
Q14-C	+0.9618 V DC
Q15A-E	+8.3 V DC
Q15A-B	+5.41 V DC
Q15A-C	+21.9 V DC
Q15B-B	+8.92 V DC
Q16A-B	+0.9625 V DC
Q16A-E	+8.7 V DC
Q16A-C	+8.77 V DC
Q16B-B	+9.37 V DC
Q17-B	+21.88 V DC
Q17-C	0.0 V DC
Q18-C	0.0 V DC
Q19-B	+7.00 V DC
Q19-E	+6.38 V DC
Q19-C	+21.57 V DC

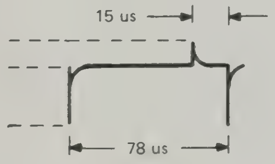


TEST POINT	TYPICAL WAVEFORM OR NOMINAL VOLTAGE	
	P/O ALT PROCESSOR A1	
Q20-G	NORM– SELF-TEST–	0.0 V DC –9.7 V DC
Q20-S		0.0 V DC
Q21-B	NORM– SELF-TEST–	+21.32 V DC +21.91 V DC
Q21-C	NORM– SELF-TEST–	+21.93 V DC –10.92 V DC
Q22-B	NORM– SELF-TEST–	+0.613 V DC 0.0 V DC
Q22-C	NORM– SELF-TEST–	0.0 V DC +21.7 V DC
Q23-B		0.0 V DC
Q23-C	NORM– SELF-TEST–	+5.43 V DC +1.2 V DC
Q24-B	NORM– SELF-TEST–	+0.873 V DC 0.00 V DC
Q24-C	NORM– SELF-TEST–	+0.255 V DC +26.70 V DC
Q25-B		+26.67 V DC
Q25-E		+26.68 V DC
Q25-C		+25.55 V DC
Q26-B		+25.6 V DC
Q26-E		+26.32 V DC
Q26-C		+26.28 V DC
Q27-B	0 V –4 V	
Q27-C	+11.3 V +1 V	
Q28-B	+100mV –5 V	
Q28-C J2	+0.1 V DC	
Q29-B	+0.1 V DC	
Q29-E	+3.22 V DC	



INPUT: AUDIO SIG AT A2J1–12,870 Hz, 5 V RMS OUT OF AUDIO SIG GEN TO TEST FIXTURE INPUT. AID = 40 FT.

TEST POINT	TYPICAL WAVEFORM OR NOMINAL VOLTAGE
	P/O ALT PROCESSOR A1
Q29C	+21.94 V DC
Q30B	+3.78 V DC
Q43C	+6.3 V DC (INDICATION VARIES WITH METER USED)
U1-2	+100 mV +20 mV –200 mV
U1-3	00.0 V DC
U1-6	+5.46 V DC
U2-3	0.0 V DC
U2-6	+0.96 V DC
U3-2	+3.2 VDC
U3-3	+3.2 V DC
U3-6	+7.1 V DC



TEST POINT	TYPICAL WAVEFORM OR NOMINAL VOLTAGE	
	P/O ALT PROCESSOR A1	
Q48-S	+28.6 mV	
Q48-G	NORM– SELF-TEST–	+21.78 V DC –0.021 V DC

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Altitude Processor A1, Voltages and Waveforms
Figure 6-16

SCHEMATIC CHANGES

REVISION IDENTIFICATION	DESCRIPTION OF REVISION AND REASON FOR CHANGE	SERVICE BULLETIN	EFFECTIVITY
None	Schematic and parts list were for assembly A1 (CPN 617-9090-002). Replaced schematic and parts list with assembly A1 (CPN 617-9090-003) to conform with production units. Changes made are as follows: C24 was 0.047 μF; deleted CR15; R68 was 33 kΩ; R97 was 10 kΩ; added R166 and R167.	NA	All models
A1	Changed VR4 and VR5 from 1N751A to 1N4625 to improve self-test switching characteristics.	None	REV AH and above
None	The following schematic errors were corrected: C5 changed from 180 μF to 180 pF, C14 changed from 20 μF to 20 pF, C32 changed from 56 μF to 56 pF.	None	All units

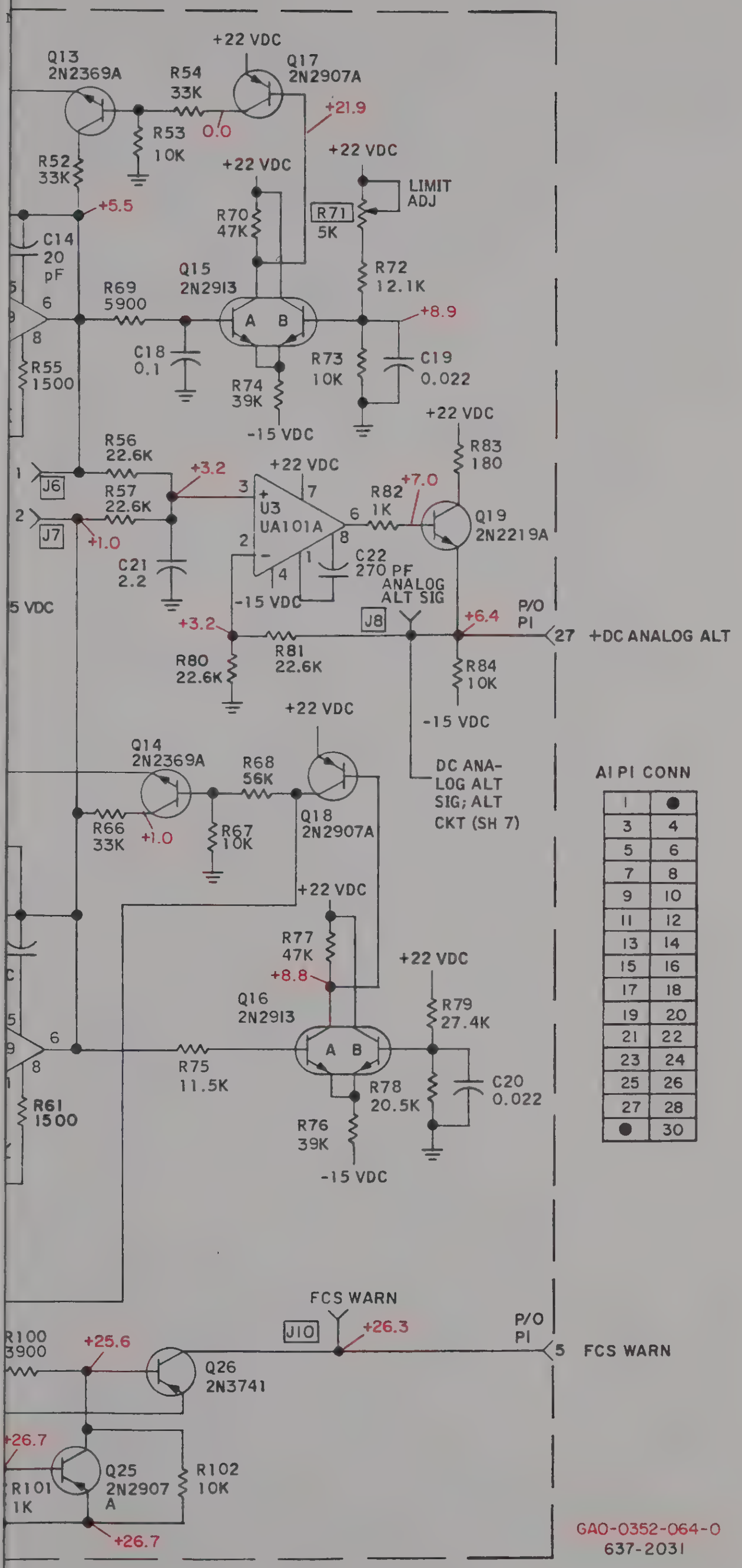
Altitude Processor A1, Schematic Diagram
Figure 6-17 (Sheet A)

PARTS LIST
ALTITUDE PROCESSOR CIRCUIT CARD ASSEMBLY A1 (PART NUMBER 617-9090-003)
LATEST EFFECTIVITY: REV AT

SYMBOL	DESCRIPTION	PART NUMBER
C1	Capacitor, fixed, mica dielectric, 68pF, 5%, 500V	912-3867-000
C2	Capacitor, fixed, mica dielectric, 56pF, 5%, 500V	912-3861-000
C3	Capacitor, fixed, mica dielectric, 750pF, 5%, 100V	912-2093-210
C4	Capacitor, fixed, electrolytic, 47μF, 20%, 35V	184-9086-730
C5	Capacitor, fixed, mica dielectric, 180pF, 5%, 500V	912-3897-000
C6	Capacitor, fixed, mica dielectric, 2200pF, 5%, 500V	912-3025-000
C7	Capacitor, fixed, mica dielectric, 330pF, 5%, 500V	912-2852-000
C8	Capacitor, fixed, plastic dielectric, 0.001μF, 10%, 200V	933-1039-070
C9	Capacitor, fixed, plastic dielectric, 0.0022μF, 10%, 200V	933-1039-080
C10	Capacitor, fixed, electrolytic, 22μF, 20%, 35V	184-7695-000
C11	Capacitor, fixed, electrolytic, 22μF, 20%, 35V	184-7695-000
C12	Capacitor, fixed, plastic dielectric, 0.68μF, 5%, 50V	933-1084-230
C13	Capacitor, fixed, plastic dielectric, 0.68μF, 5%, 50V	933-1084-230
C14	Capacitor, fixed, mica dielectric, 20pF, 5%, 500V	912-3841-000
C15	Capacitor, fixed, mica dielectric, 20pF, 5%, 500V	912-3841-000
C16	Capacitor, fixed, ceramic dielectric, 470pF, 10%, 200V	913-4014-000
C17	Capacitor, fixed, ceramic dielectric, 470pF, 10%, 200V	913-4014-000
C18	Capacitor, fixed, ceramic dielectric, 0.1μF, 10%, 50V	913-5019-320
C19	Capacitor, fixed, ceramic dielectric, 0.022μF, 10%, 50V	913-5019-240
C20	Capacitor, fixed, ceramic dielectric, 0.022μF, 10%, 50V	913-5019-240
C21	Capacitor, fixed, plastic dielectric, 2.2μF, 10%, 50V	933-1081-250
C22	Capacitor, fixed, ceramic dielectric, 270pF, 10%, 200V	913-4011-000
C23	Capacitor, fixed, electrolytic, 1μF, 20%, 35V	184-7398-000
C24	Capacitor, fixed, electrolytic, 6.8μF, 10%, 6V	184-9086-020
C25	Capacitor, fixed, mica dielectric, 24pF, 5%, 500V	912-3843-000
C26	Capacitor, fixed, ceramic dielectric, 0.01μF, -20% +80%, 100V	913-3680-000
C27	Capacitor, fixed, electrolytic, 0.15μF, 20%, 35V	184-7418-000
C28	Capacitor, fixed, mica dielectric, 68pF, 5%, 500V	912-3867-000
C29	Capacitor, fixed, mica dielectric, 68pF, 5%, 500V	912-3867-000
C30	Capacitor, fixed, electrolytic, 6.8μF, 20%, 35V	184-7693-000
C31	Capacitor, fixed, electrolytic, 22μF, 20%, 35V	184-7695-000
C32	Capacitor, fixed, mica dielectric, 56pF, 5%, 500V	912-3861-000
CR1	Diode, 1N3064	353-3404-000
CR2	Diode, 1N3064	353-3404-000
CR3	Diode, 1N3064	353-3404-000
CR4	Diode, 1N3064	353-3404-000
CR5	Diode, 1N3064	353-3404-000
CR6	Diode, 1N3064	353-3404-000
CR7	Diode, 1N3064	353-3404-000
CR8	Diode, 1N3064	353-3404-000
CR9	Diode, 1N3064	353-3404-000
CR10	Diode, 1N3064	353-3404-000
CR11	Diode, 1N3064	353-3404-000
CR12	Diode, 1N4454	353-3644-010
CR13	Not used	
CR14	Diode, 1N3064	353-3404-000
CR15	Not used	
CR16	Diode, 1N3064	353-3404-000
CR17	Not used	
CR18	Diode, 1N3064	353-3404-000
CR19	Diode, 1N3064	353-3404-000
CR20	Diode, 1N3064	353-3404-000
CR21	Diode, 1N4454	353-3644-010
CR22	Diode, 1N4454	353-3644-010
CR23	Diode, 1N4454	353-3644-010
J1	Jack	360-0437-010
J2	Jack	360-0437-010
J3	Jack	360-0437-010
J4	Jack	360-0437-000
J5	Jack	360-0437-000
J6	Jack	360-0437-000
J7	Jack	360-0437-000
J8	Jack	360-0437-000
J9	Jack	360-0437-000
J10	Jack	360-0437-000
J11	Jack	360-0437-000
J12	Jack	360-0437-000
J13	Jack	360-0437-000
J14	Jack	360-0437-000
J15	Jack	360-0437-000
P1	Connector, elec	634-0033-020
Q1	Transistor, 2N2540	352-0509-000
Q2	Transistor, 2N4093	352-0759-030
Q3	Transistor, 2N2907A	352-0551-010
Q4	Transistor, 2N2222A	352-0661-020
Q5	Transistor, 2N2484	352-0549-000
Q6	Transistor, 2N2484	352-0549-000
Q7	Transistor, 2N2369A	352-0596-020
Q8	Transistor, 2N2369A	352-0596-020
Q9	Transistor, 2N2369A	352-0596-020
Q10	Transistor, 2N2369A	352-0596-020
Q11	Transistor, 2N4093	352-0759-030
Q12	Transistor, 2N4093	352-0759-030
Q13	Transistor, 2N2369A	352-0596-020
Q14	Transistor, 2N2369A	352-0596-020
Q15	Transistor, 2N2913	352-0620-010
Q16	Transistor, 2N2913	352-0620-010
Q17	Transistor, 2N2907 (eff to REV AM)	352-0551-000
Q17	Transistor, 2N2907A (eff REV AM)	352-0551-010
Q18	Transistor, 2N2907 (eff to REV AM	352-0551-000
Q18	Transistor, 2N2907A (eff REV AM)	352-0551-010
Q19	Transistor, 2N2219A	352-0661-010
Q20	Transistor, 2N4092	352-0759-020
Q21	Transistor, 2N2907A	352-0551-010
Q22	Transistor, 2N956	352-0400-010
Q23	Transistor, 2N2222A	352-0661-020
Q24	Transistor, 2N956	352-0400-010
Q25	Transistor, 2N2907 (eff to REV AM)	352-0551-000
Q25	Transistor, 2N2907A (eff REV AM)	352-0551-010
Q26	Transistor, 2N3741	352-0695-020
Q27	Transistor, 2N2369A	352-0596-020
Q28	Transistor, 2N2369A	352-0596-020
Q29	Transistor, 2N2484	352-0549-000
Q30	Transistor, 2N2484	352-0549-000
Q31	Transistor, 2N2907 (eff to REV AM)	352-0551-000
Q31	Transistor, 2N2907A (eff REV AM)	352-0551-010
Q32	Transistor, 2N2222A	352-0661-020
Q33	Transistor, 2N1711 (eff to REV AE)	352-0400-000
Q33	Transistor, 2N1711 (eff REV AE)	618-4921-063
Q34	Transistor, 2N2907 (eff to REV AM)	352-0551-000
Q34	Transistor, 2N2907A (eff REV AM)	352-0551-010
Q35	Transistor, 2N2222A	352-0661-020
Q36	Transistor, 2N1711 (eff to REV AE)	352-0400-000
Q36	Transistor, 2N1711A (eff REV AE)	618-4921-063
Q37	Transistor, 2N2907 (eff to REV AM)	352-0551-000
Q37	Transistor, 2N2907A (eff REV AM)	352-0551-010
Q38	Transistor, 2N2222A	352-0661-020
Q39	Transistor, 2N1711 (eff to REV AE)	352-0400-000
Q39	Transistor, 2N1711A (eff REV AE)	618-4921-063
Q40	Transistor, 2N2907 (eff to REV AM)	352-0551-000
Q40	Transistor, 2N2907A (eff REV AM)	352-0551-010
Q41	Transistor, 2N2222A	352-0661-020
Q42	Transistor, 2N1711 (eff to REV AE)	352-0400-000
Q42	Transistor, 2N1711A (eff REV AE)	618-4921-063
Q43	Transistor, 2N2907 (eff to REV AM)	352-0551-000
Q43	Transistor, 2N2907A (eff REV AM)	352-0551-010
Q44	Transistor, 2N2222A	352-0661-020
Q45	Transistor, 2N2222A	352-0661-020
Q46	Transistor, 2N2222A	352-0661-020
Q47	Transistor, 2N2222A	352-0661-020
Q48	Transistor, 2N2608	352-0605-010
R1	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R2	Resistor, fixed, composition, 6800Ω, 10%, 1/4W	745-0779-000
R3	Resistor, fixed, composition, 1kΩ, 10%, 1/2W	745-1352-000
R4	Resistor, fixed, composition, 6800Ω, 10%, 1/4W	745-0779-000
R5	Resistor, fixed, composition, 470Ω, 10%, 1/4W	745-0737-000
R6	Resistor, fixed, composition, 1kΩ, 10%, 1/4W	745-0749-000
R7	Resistor, fixed, composition, 39kΩ, 10%, 1/4W	745-0806-000
R8	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R9	Resistor, fixed, composition, 5600Ω, 10%, 1/4W	745-0776-000
R10-R20	Not used	
R21	Resistor, variable, wire-wound, 5kΩ, 5%, 3/4W	381-1721-120
R22	Resistor, fixed, film, 14.7kΩ, 1%, 1/8W	705-6301-000
R23	Resistor, fixed, film, 3160Ω, 1%, 1/8W	705-1454-510
R24	Resistor, fixed, composition, 470Ω, 10%, 1/4W	745-0737-000
R25	Resistor, fixed, film, 1910Ω, 1%, 1/8W	705-1468-070
R26	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R27	Resistor, fixed, film, 1960Ω, 1%, 1/8W	705-1454-460
R28	Resistor, fixed, film, 3160Ω, 1%, 1/8W	705-1454-510
R29	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R30	Resistor, fixed, composition, 4.7MΩ, 10%, 1/4W	745-0881-000
R31	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R32	Resistor, fixed, film, 1960Ω, 1%, 1/8W	705-1454-460
R33	Resistor, fixed, film, 14.7kΩ, 1%, 1/8W	705-6301-000
R34	Resistor, fixed, film, 3160Ω, 1%, 1/8W	705-1454-510
R35	Resistor, variable, wire-wound, 5kΩ, 5%, 3/4W	381-1721-120
R36	Resistor, fixed, composition, 470Ω, 10%, 1/4W	745-0737-000
R37	Resistor, fixed, film, 1910Ω, 1%, 1/8W	705-1468-070
R38	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R39	Resistor, fixed, film, 3160Ω, 1%, 1/8W	705-1454-510
R40	Resistor, fixed, composition, 4.7MΩ, 10%, 1/4W	745-0881-000
R41	Resistor, fixed, film, 48.7kΩ, 0.1%, 1/8W	705-1484-890
R42	Resistor, fixed, film, 51.1kΩ, 1%, 1/8W (eff to REV AK)	705-1454-800
R42	Resistor, fixed, film, 51.1kΩ, 1%, 1/8W (eff REV AK)	705-1078-000
R43	Resistor, fixed, film, 2370Ω, 1%, 1/8W	705-1454-480
R44	Resistor, fixed, composition, 150kΩ, 10%, 1/4W	745-0827-000
R45	Resistor, variable, wire-wound, 5kΩ, 5%, 3/4W	381-1721-120
R46	Resistor, fixed, film, 82.5kΩ, 1%, 1/8W (eff to REV AK)	705-1454-850
R46	Resistor, fixed, film, 82.5kΩ, 1%, 1/8W (eff REV AK)	705-1088-000
R47	Resistor, fixed, composition, 330Ω, 10%, 1/4W	745-0731-000
R48	Resistor, fixed, composition, 390Ω, 10%, 1/4W	745-0734-000
R49	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R50	Resistor, fixed, composition, 47kΩ, 10%, 1/4W	745-0809-000
R51	Resistor, fixed, film, 90.9kΩ, 0.1%, 1/8W	705-1485-160
R52	Resistor, fixed, composition, 33kΩ, 10%, 1/4W	745-0803-000
R53	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R54	Resistor, fixed, composition, 33kΩ, 10%, 1/4W	745-0803-000
R55	Resistor, fixed, composition, 1500Ω, 10%, 1/4W	745-0755-000
R56	Resistor, fixed, film, 22.6kΩ, 0.1%, 1/10W	705-5976-160
R57	Resistor, fixed, film, 22.6kΩ, 0.1%, 1/10W	705-5976-160
R58	Resistor, variable, wire-wound, 5kΩ, 5%, 3/4W	381-1721-120
R59	Resistor, fixed, composition, 220kΩ, 10%, 1/4W	745-0833-000
R60	Resistor, fixed, film, 82.5kΩ, 1%, 1/8W (eff to REV AK)	705-1454-850
R60	Resistor, fixed, film, 82.5kΩ, 1%, 1/8W (eff REV AK)	705-1088-000
R61	Resistor, fixed, composition, 1500Ω, 10%, 1/4W	745-0755-000
R62	Resistor, fixed, film, 48.7kΩ, 0.1%, 1/8W	705-1484-890
R63	Resistor, fixed, film, 16.2kΩ, 1%, 1/8W	705-1454-680
R64	Resistor, fixed, film, 287kΩ, 1%, 1/8W (eff to REV AK)	705-1454-980
R64	Resistor, fixed, film, 287kΩ, 1%, 1/8W (eff REV AK)	705-1114-000
R65	Resistor, fixed, film, 90.9kΩ, 0.1%, 1/8W	705-1485-160
R66	Resistor, fixed, composition, 33kΩ, 10%, 1/4W	745-0803-000
R67	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R68	Resistor, fixed, composition, 56kΩ, 10%, 1/4W	745-0812-000

PARTS LIST
ALTITUDE PROCESSOR CIRCUIT CARD ASSEMBLY A1 (PART
LATEST EFFECTIVITY: REV AM

SYMBOL	DESCRIPTION
R69	Resistor, fixed, film, 5900Ω, 1%, 1/8W
R70	Resistor, fixed, composition, 47kΩ, 10%, 1/4W
R71	Resistor, variable, wire-wound, 5kΩ, 5%, 3/4W
R72	Resistor, fixed, film, 12.1kΩ, 1%, 1/8W
R73	Resistor, fixed, film, 10kΩ, 1%, 1/8W
R74	Resistor, fixed, composition, 39kΩ, 10%, 1/4W
R75	Resistor, fixed, film, 11.5kΩ, 1%, 1/8W
R76	Resistor, fixed, composition, 39kΩ, 10%, 1/4W
R77	Resistor, fixed, composition, 47kΩ, 10%, 1/4W
R78	Resistor, fixed, film, 20.5kΩ, 1%, 1/8W
R79	Resistor, fixed, film, 27.4kΩ, 1%, 1/8W
R80	Resistor, fixed, film, 22.6kΩ, 0.1%, 1/10W
R81	Resistor, fixed, film, 22.6kΩ, 0.1%, 1/10W
R82	Resistor, fixed, composition, 1kΩ, 10%, 1/4W
R83	Resistor, fixed, composition, 180Ω, 10%, 1/2W
R84	Resistor, fixed, composition, 10kΩ, 10%, 1/4W
R85	Resistor, fixed, film, 301Ω, 1%, 1/8W
R86	Resistor, fixed, film, 25.5kΩ, 1%, 1/8W
R87	Resistor, fixed, film, 100Ω, 1%, 1/8W
R88	Resistor, fixed, film, 100Ω, 1%, 1/8W
R89	Resistor, fixed, film, 14.7kΩ, 1%, 1/8W
R90	Resistor, fixed, composition, 270kΩ, 10%, 1/4W
R91	Resistor, fixed, composition, 47kΩ, 10%, 1/4W
R92	Resistor, fixed, composition, 22kΩ, 10%, 1/4W
R93	Resistor, fixed, composition, 100kΩ, 10%, 1/4W
R94	Resistor, fixed, composition, 22kΩ, 10%, 1/4W
R95	Resistor, fixed, composition, 47kΩ, 10%, 1/4W
R96	Resistor, fixed, composition, 33kΩ, 10%, 1/4W
R97	Resistor, fixed, composition, 22kΩ, 10%, 1/4W
R98	Resistor, fixed, composition, 39kΩ, 10%, 1/4W
R99	Resistor, fixed, composition, 22kΩ, 10%, 1/4W
R100	Resistor, fixed, composition, 3900Ω, 10%, 1/4W
R101	Resistor, fixed, composition, 1kΩ, 10%, 1/4W
R102	Resistor, fixed, composition, 10kΩ, 10%, 1/4W
R103	Resistor, fixed, composition, 10Ω, 10%, 1/2W
R104	Resistor, fixed, composition, 8200Ω, 10%, 1/4W
R105	Resistor, fixed, composition, 10kΩ, 10%, 1/4W
R106	Resistor, fixed, composition, 33kΩ, 10%, 1/4W
R107	Resistor, fixed, composition, 22kΩ, 10%, 1/4W
R108	Resistor, fixed, composition, 5600Ω, 10%, 1/4W
R109	Resistor, fixed, composition, 39kΩ, 10%, 1/4W
R110	Resistor, fixed, composition, 33kΩ, 10%, 1/4W
R111	Resistor, variable, wire-wound, 10kΩ, 5%, 3/4W
R112	Resistor, fixed, composition, 10kΩ, 10%, 1/4W
R113	Resistor, fixed, composition, 10kΩ, 10%, 1/4W
R114	Resistor, fixed, composition, 22kΩ, 10%, 1/4W
R115	Resistor, fixed, composition, 22kΩ, 10%, 1/4W
R116	Resistor, fixed, composition, 22kΩ, 10%, 1/4W
R117	Resistor, fixed, composition, 22kΩ, 10%, 1/4W
R118	Resistor, fixed, composition, 82kΩ, 10%, 1/4W
R119	Resistor, fixed, composition, 6800Ω, 10%, 1/4W
R120	Resistor, fixed, composition, 100kΩ, 10%, 1/4W
R121	Resistor, fixed, composition, 15kΩ, 10%, 1/4W
R122	Resistor, fixed, composition, 470kΩ, 10%, 1/4W
R123	Resistor, fixed, composition, 100kΩ, 10%, 1/4W
R124	Resistor, fixed, composition, 33kΩ, 10%, 1/4W
R125	Resistor, fixed, composition, 39kΩ, 10%, 1/4W
R126	Resistor, fixed, composition, 560kΩ, 10%, 1/4W
R127	Resistor, fixed, composition, 6190Ω, 1%, 1/8W
R128	Resistor, fixed, composition, 10kΩ, 10%, 1/4W
R129	Resistor, fixed, composition, 1500Ω, 10%, 1/2W
R130	Resistor, fixed, composition, 1kΩ, 10%, 1/4W
R131	Resistor, fixed, composition, 33kΩ, 10%, 1/4W
R132	Resistor, fixed, composition, 39kΩ, 10%, 1/4W
R133	Resistor, fixed, composition, 560kΩ, 10%, 1/4W
R134	Resistor, fixed, composition, 1500Ω, 10%, 1/2W
R135	Resistor, fixed, composition, 6190Ω, 1%, 1/8W
R136	Resistor, fixed, composition, 10kΩ, 10%, 1/4W
R137	Resistor, variable, 20kΩ, 5%, 3/4W
R138	Resistor, variable, 20kΩ, 5%, 3/4W
R139	Resistor, fixed, composition, 1kΩ, 10%, 1/4W
R140	Resistor, fixed, composition, 10kΩ, 10%, 1/4W
R141	Resistor, fixed, composition, 10kΩ, 10%, 1/4W
R142	Resistor, fixed, composition, 10kΩ, 10%, 1/4W
R143	Resistor, fixed, composition, 10kΩ, 10%, 1/4W
R144	Resistor, fixed, composition, 33kΩ, 10%, 1/4W
R145	Resistor, fixed, composition, 560kΩ, 10%, 1/4W
R146	Resistor, fixed, composition, 39kΩ, 10%, 1/4W
R147	Resistor, fixed, film, 6190Ω, 1%, 1/8W
R148	Resistor, fixed, composition, 10kΩ, 10%, 1/4W
R149	Resistor, variable, 20kΩ, 5%, 3/4W
R150	Resistor, fixed, composition, 1kΩ, 10%, 1/4W
R151	Resistor, fixed, composition, 33kΩ, 10%, 1/4W
R152	Resistor, fixed, composition, 39kΩ, 10%, 1/4W
R153	Resistor, fixed, composition, 560kΩ, 10%, 1/4W
R154	Resistor, fixed, composition, 1500Ω, 10%, 1/2W
R155	Resistor, fixed, film, 6190Ω, 1%, 1/8W
R156	Resistor, fixed, composition, 10kΩ, 10%, 1/4W
R157	Resistor, variable, 20kΩ, 5%, 3/4W
R158	Resistor, fixed, composition, 1kΩ, 10%, 1/4W
R159	Resistor, fixed, composition, 1500Ω, 10%, 1/2W
R160	Resistor, fixed, composition, 100Ω, 10%, 1/4W
R161	Resistor, fixed, composition, 15kΩ, 10%, 1/4W
R162	Resistor, fixed, composition, 22kΩ, 10%, 1/4W
R163	Resistor, fixed, composition, 47kΩ, 10%, 1/4W
R164	Resistor, fixed, film, 75kΩ, 1%, 1/8W
R165	Resistor, fixed, film, 1000Ω, 1%, 1/8W


+22 VDC
Q13 2N2369A
R54 33K
Q17 2N2907A
+21.9
R53 10K
0.0
R52 33K
+22 VDC
+22 VDC
LIMIT ADJ
+5.5
R70 47K
R71 5K
C14 20 pF
Q15 2N2913
R72 12.1K
R69 5900
A B
+8.9
C18 0.1
R73 10K
C19 0.022
R55 1500
R74 39K
-15 VDC
+22 VDC
R56 22.6K
+3.2
+22 VDC
R83 180
J6
R57 22.6K
U3 UA101A
+7.0
R82 1K
Q19 2N2219A
J7
+1.0
C21 2.2
C22 270 PF
-15 VDC
ANALOG ALT SIG
5 VDC
+3.2
J8
+6.4
P/O PI
27 +DC ANALOG ALT
R80 22.6K
R81 22.6K
R84 10K
+22 VDC
-15 VDC
Q14 2N2369A
R68 56K
DC ANALOG ALT SIG; ALT CKT (SH 7)
R66 33K
+1.0
R67 10K
Q18 2N2907A
AI PI CONN
+22 VDC
R77 47K
+22 VDC
+8.8
Q16 2N2913
R79 27.4K
R75 11.5K
A B
R78 20.5K
C20 0.022
R61 1500
R76 39K
-15 VDC
FCS WARN
J10
+26.3
P/O PI
5 FCS WARN
R100 3900
+25.6
Q26 2N3741
+26.7
Q25 2N2907 A
R102 10K
R101 1K
+26.7
GAO-0352-064-0
637-2031

1	●
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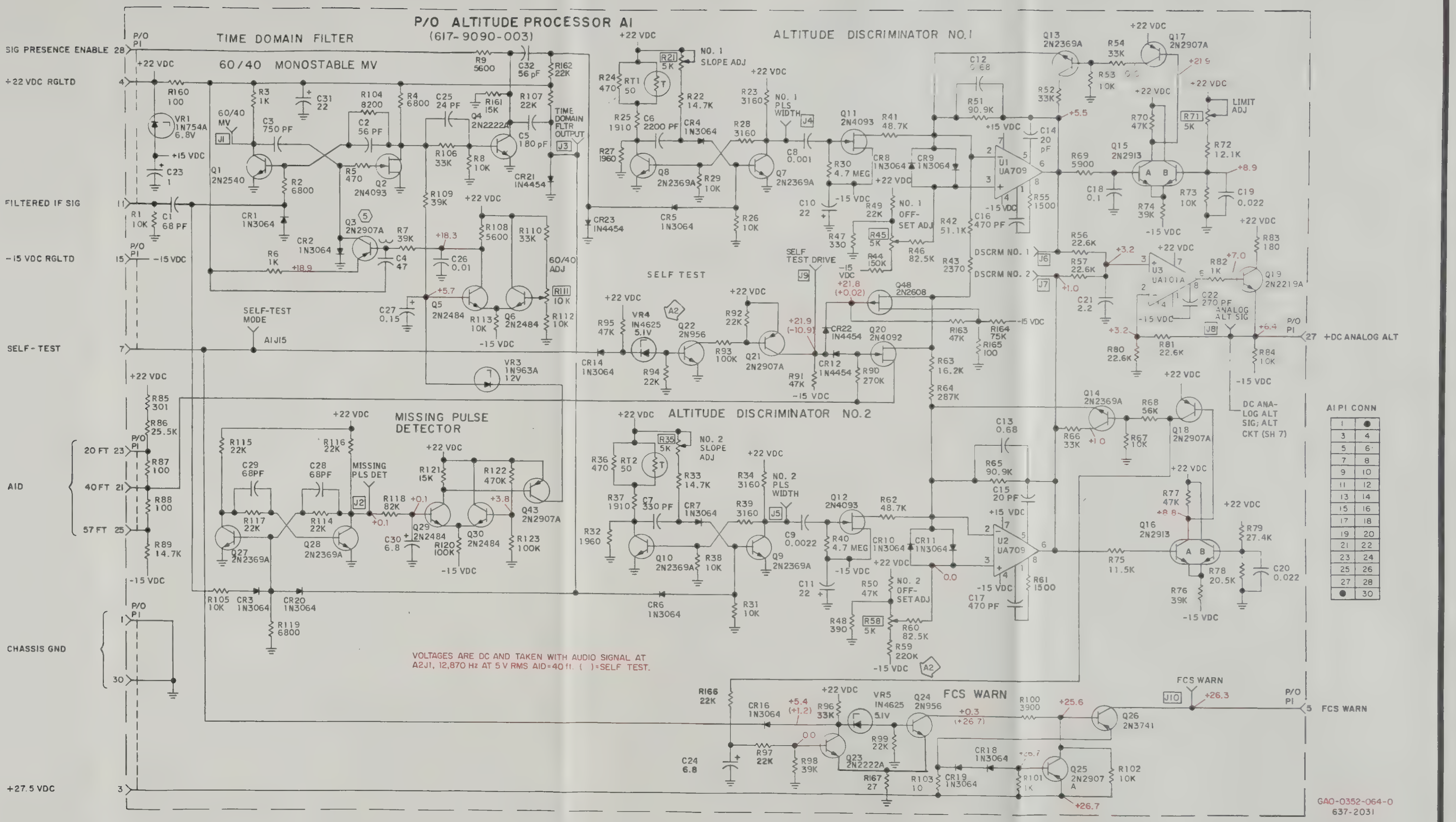
Altitude Processor A1, Schematic Diagram
Figure 6-17 (Sheet 1 of 2)

PARTS LIST
ALTITUDE PROCESSOR CIRCUIT CARD ASSEMBLY A1 (PART NUMBER 617-9090-003)
LATEST EFFECTIVITY: REV AT

SYMBOL	DESCRIPTION	PART NUMBER
C1	Capacitor, fixed, mica dielectric, 68pF, 5%, 500V	912-3867-000
C2	Capacitor, fixed, mica dielectric, 56pF, 5%, 500V	912-3861-000
C3	Capacitor, fixed, mica dielectric, 750pF, 5%, 100V	912-2093-210
C4	Capacitor, fixed, electrolytic, 47µF, 20%, 35V	184-9086-730
C5	Capacitor, fixed, mica dielectric, 180pF, 5%, 500V	912-3897-000
C6	Capacitor, fixed, mica dielectric, 2200pF, 5%, 500V	912-3025-000
C7	Capacitor, fixed, mica dielectric, 330pF, 5%, 500V	912-2852-000
C8	Capacitor, fixed, plastic dielectric, 0.001µF, 10%, 200V	933-1039-070
C9	Capacitor, fixed, plastic dielectric, 0.0022µF, 10%, 200V	933-1039-080
C10	Capacitor, fixed, electrolytic, 22µF, 20%, 35V	184-7695-000
C11	Capacitor, fixed, electrolytic, 22µF, 20%, 35V	184-7695-000
C12	Capacitor, fixed, plastic dielectric, 0.68µF, 5%, 50V	933-1084-230
C13	Capacitor, fixed, plastic dielectric, 0.68µF, 5%, 50V	933-1084-230
C14	Capacitor, fixed, mica dielectric, 20pF, 5%, 500V	912-3841-000
C15	Capacitor, fixed, mica dielectric, 20pF, 5%, 500V	912-3841-000
C16	Capacitor, fixed, ceramic dielectric, 470pF, 10%, 200V	913-4014-000
C17	Capacitor, fixed, ceramic dielectric, 470pF, 10%, 200V	913-4014-000
C18	Capacitor, fixed, ceramic dielectric, 0.1µF, 10%, 50V	913-5019-320
C19	Capacitor, fixed, ceramic dielectric, 0.022µF, 10%, 50V	913-5019-240
C20	Capacitor, fixed, ceramic dielectric, 0.022µF, 10%, 50V	913-5019-240
C21	Capacitor, fixed, plastic dielectric, 2.2µF, 10%, 50V	933-1081-250
C22	Capacitor, fixed, ceramic dielectric, 270pF, 10%, 200V	913-4011-000
C23	Capacitor, fixed, electrolytic, 1µF, 20%, 35V	184-7398-000
C24	Capacitor, fixed, electrolytic, 6.8µF, 10%, 6V	184-9086-020
C25	Capacitor, fixed, mica dielectric, 24pF, 5%, 500V	912-3843-000
C26	Capacitor, fixed, ceramic dielectric, 0.01µF, -20% +80%, 100V	913-3680-000
C27	Capacitor, fixed, electrolytic, 0.15µF, 20%, 35V	184-7418-000
C28	Capacitor, fixed, mica dielectric, 68pF, 5%, 500V	912-3867-000
C29	Capacitor, fixed, mica dielectric, 68pF, 5%, 500V	912-3867-000
C30	Capacitor, fixed, electrolytic, 6.8µF, 20%, 35V	184-7693-000
C31	Capacitor, fixed, electrolytic, 22µF, 20%, 35V	184-7695-000
C32	Capacitor, fixed, mica dielectric, 56pF, 5%, 500V	912-3861-000
CR1	Diode, 1N3064	353-3404-000
CR2	Diode, 1N3064	353-3404-000
CR3	Diode, 1N3064	353-3404-000
CR4	Diode, 1N3064	353-3404-000
CR5	Diode, 1N3064	353-3404-000
CR6	Diode, 1N3064	353-3404-000
CR7	Diode, 1N3064	353-3404-000
CR8	Diode, 1N3064	353-3404-000
CR9	Diode, 1N3064	353-3404-000
CR10	Diode, 1N3064	353-3404-000
CR11	Diode, 1N3064	353-3404-000
CR12	Diode, 1N4454	353-3644-010
CR13	Not used	
CR14	Diode, 1N3064	353-3404-000
CR15	Not used	
CR16	Diode, 1N3064	353-3404-000
CR17	Not used	
CR18	Diode, 1N3064	353-3404-000
CR19	Diode, 1N3064	353-3404-000
CR20	Diode, 1N3064	353-3404-000
CR21	Diode, 1N4454	353-3644-010
CR22	Diode, 1N4454	353-3644-010
CR23	Diode, 1N4454	353-3644-010
J1	Jack	360-0437-010
J2	Jack	360-0437-010
J3	Jack	360-0437-010
J4	Jack	360-0437-000
J5	Jack	360-0437-000
J6	Jack	360-0437-000
J7	Jack	360-0437-000
J8	Jack	360-0437-000
J9	Jack	360-0437-000
J10	Jack	360-0437-000
J11	Jack	360-0437-000
J12	Jack	360-0437-000
J13	Jack	360-0437-000
J14	Jack	360-0437-000
J15	Jack	360-0437-000
P1	Connector, elec	634-0033-020
Q1	Transistor, 2N2540	352-0509-000
Q2	Transistor, 2N4093	352-0759-030
Q3	Transistor, 2N2907A	352-0551-010
Q4	Transistor, 2N2222A	352-0661-020
Q5	Transistor, 2N2484	352-0549-000
Q6	Transistor, 2N2484	352-0549-000
Q7	Transistor, 2N2369A	352-0596-020
Q8	Transistor, 2N2369A	352-0596-020
Q9	Transistor, 2N2369A	352-0596-020
Q10	Transistor, 2N2369A	352-0596-020
Q11	Transistor, 2N4093	352-0759-030
Q12	Transistor, 2N4093	352-0759-030
Q13	Transistor, 2N2369A	352-0596-020
Q14	Transistor, 2N2369A	352-0596-020
Q15	Transistor, 2N2913	352-0620-010
Q16	Transistor, 2N2913	352-0620-010
Q17	Transistor, 2N2907 (eff to REV AM)	352-0551-000
Q17	Transistor, 2N2907A (eff REV AM)	352-0551-010
Q18	Transistor, 2N2907 (eff to REV AM	352-0551-000
Q18	Transistor, 2N2907A (eff REV AM)	352-0551-010
Q19	Transistor, 2N2219A	352-0661-010
Q20	Transistor, 2N4092	352-0759-020
Q21	Transistor, 2N2907A	352-0551-010
Q22	Transistor, 2N956	352-0400-010
Q23	Transistor, 2N2222A	352-0661-020
Q24	Transistor, 2N956	352-0400-010
Q25	Transistor, 2N2907 (eff to REV AM)	352-0551-000
Q25	Transistor, 2N2907A (eff REV AM)	352-0551-010
Q26	Transistor, 2N3741	352-0695-020
Q27	Transistor, 2N2369A	352-0596-020
Q28	Transistor, 2N2369A	352-0596-020
Q29	Transistor, 2N2484	352-0549-000
Q30	Transistor, 2N2484	352-0549-000
Q31	Transistor, 2N2907 (eff to REV AM)	352-0551-000
Q31	Transistor, 2N2907A (eff REV AM)	352-0551-010
Q32	Transistor, 2N2222A	352-0661-020
Q33	Transistor, 2N1711 (eff to REV AE)	352-0400-000
Q33	Transistor, 2N1711 (eff REV AE)	618-4921-063
Q34	Transistor, 2N2907 (eff to REV AM)	352-0551-000
Q34	Transistor, 2N2907A (eff REV AM)	352-0551-010
Q35	Transistor, 2N2222A	352-0661-020
Q36	Transistor, 2N1711 (eff to REV AE)	352-0400-000
Q36	Transistor, 2N1711A (eff REV AE)	618-4921-063
Q37	Transistor, 2N2907 (eff to REV AM)	352-0551-000
Q37	Transistor, 2N2907A (eff REV AM)	352-0551-010
Q38	Transistor, 2N2222A	352-0661-020
Q39	Transistor, 2N1711 (eff to REV AE)	352-0400-000
Q39	Transistor, 2N1711A (eff REV AE)	618-4921-063
Q40	Transistor, 2N2907 (eff to REV AM)	352-0551-000
Q40	Transistor, 2N2907A (eff REV AM)	352-0551-010
Q41	Transistor, 2N2222A	352-0661-020
Q42	Transistor, 2N1711 (eff to REV AE)	352-0400-000
Q42	Transistor, 2N1711A (eff REV AE)	618-4921-063
Q43	Transistor, 2N2907 (eff to REV AM)	352-0551-000
Q43	Transistor, 2N2907A (eff REV AM)	352-0551-010
Q44	Transistor, 2N2222A	352-0661-020
Q45	Transistor, 2N2222A	352-0661-020
Q46	Transistor, 2N2222A	352-0661-020
Q47	Transistor, 2N2222A	352-0661-020
Q48	Transistor, 2N2608	352-0605-010
R1	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R2	Resistor, fixed, composition, 6800Ω, 10%, 1/4W	745-0779-000
R3	Resistor, fixed, composition, 1kΩ, 10%, 1/2W	745-1352-000
R4	Resistor, fixed, composition, 6800Ω, 10%, 1/4W	745-0779-000
R5	Resistor, fixed, composition, 470Ω, 10%, 1/4W	745-0737-000
R6	Resistor, fixed, composition, 1kΩ, 10%, 1/4W	745-0749-000
R7	Resistor, fixed, composition, 39kΩ, 10%, 1/4W	745-0806-000
R8	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R9	Resistor, fixed, composition, 5600Ω, 10%, 1/4W	745-0776-000
R10-R20	Not used	
R21	Resistor, variable, wire-wound, 5kΩ, 5%, 3/4W	381-1721-120
R22	Resistor, fixed, film, 14.7kΩ, 1%, 1/8W	705-6301-000
R23	Resistor, fixed, film, 3160Ω, 1%, 1/8W	705-1454-510
R24	Resistor, fixed, composition, 470Ω, 10%, 1/4W	745-0737-000
R25	Resistor, fixed, film, 1910Ω, 1%, 1/8W	705-1468-070
R26	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R27	Resistor, fixed, film, 1960Ω, 1%, 1/8W	705-1454-460
R28	Resistor, fixed, film, 3160Ω, 1%, 1/8W	705-1454-510
R29	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R30	Resistor, fixed, composition, 4.7MΩ, 10%, 1/4W	745-0881-000
R31	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R32	Resistor, fixed, film, 1960Ω, 1%, 1/8W	705-1454-460
R33	Resistor, fixed, film, 14.7kΩ, 1%, 1/8W	705-6301-000
R34	Resistor, fixed, film, 3160Ω, 1%, 1/8W	705-1454-510
R35	Resistor, variable, wire-wound, 5kΩ, 5%, 3/4W	381-1721-120
R36	Resistor, fixed, composition, 470Ω, 10%, 1/4W	745-0737-000
R37	Resistor, fixed, film, 1910Ω, 1%, 1/8W	705-1468-070
R38	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R39	Resistor, fixed, film, 3160Ω, 1%, 1/8W	705-1454-510
R40	Resistor, fixed, composition, 4.7MΩ, 10%, 1/4W	745-0881-000
R41	Resistor, fixed, film, 48.7kΩ, 0.1%, 1/8W	705-1484-890
R42	Resistor, fixed, film, 51.1kΩ, 1%, 1/8W (eff to REV AK)	705-1454-800
R42	Resistor, fixed, film, 51.1kΩ, 1%, 1/8W (eff REV AK)	705-1078-000
R43	Resistor, fixed, film, 2370Ω, 1%, 1/8W	705-1454-480
R44	Resistor, fixed, composition, 150kΩ, 10%, 1/4W	745-0827-000
R45	Resistor, variable, wire-wound, 5kΩ, 5%, 3/4W	381-1721-120
R46	Resistor, fixed, film, 82.5kΩ, 1%, 1/8W (eff to REV AK)	705-1454-850
R46	Resistor, fixed, film, 82.5kΩ, 1%, 1/8W (eff REV AK)	705-1088-000
R47	Resistor, fixed, composition, 330Ω, 10%, 1/4W	745-0731-000
R48	Resistor, fixed, composition, 390Ω, 10%, 1/4W	745-0734-000
R49	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R50	Resistor, fixed, composition, 47kΩ, 10%, 1/4W	745-0809-000
R51	Resistor, fixed, film, 90.9kΩ, 0.1%, 1/8W	705-1485-160
R52	Resistor, fixed, composition, 33kΩ, 10%, 1/4W	745-0803-000
R53	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R54	Resistor, fixed, composition, 33kΩ, 10%, 1/4W	745-0803-000
R55	Resistor, fixed, composition, 1500Ω, 10%, 1/4W	745-0755-000
R56	Resistor, fixed, film, 22.6kΩ, 0.1%, 1/10W	705-5976-160
R57	Resistor, fixed, film, 22.6kΩ, 0.1%, 1/10W	705-5976-160
R58	Resistor, variable, wire-wound, 5kΩ, 5%, 3/4W	381-1721-120
R59	Resistor, fixed, composition, 220kΩ, 10%, 1/4W	745-0833-000
R60	Resistor, fixed, film, 82.5kΩ, 1%, 1/8W (eff to REV AK)	705-1454-850
R60	Resistor, fixed, film, 82.5kΩ, 1%, 1/8W (eff REV AK)	705-1088-000
R61	Resistor, fixed, composition, 1500Ω, 10%, 1/4W	745-0755-000
R62	Resistor, fixed, film, 48.7kΩ, 0.1%, 1/8W	705-1484-890
R63	Resistor, fixed, film, 16.2kΩ, 1%, 1/8W	705-1454-680
R64	Resistor, fixed, film, 287kΩ, 1%, 1/8W (eff to REV AK)	705-1454-980
R64	Resistor, fixed, film, 287kΩ, 1%, 1/8W (eff REV AK)	705-1114-000
R65	Resistor, fixed, film, 90.9kΩ, 0.1%, 1/8W	705-1485-160
R66	Resistor, fixed, composition, 33kΩ, 10%, 1/4W	745-0803-000
R67	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R68	Resistor, fixed, composition, 56kΩ, 10%, 1/4W	745-0812-000

PARTS LIST
ALTITUDE PROCESSOR CIRCUIT CARD ASSEMBLY A1 (PART NUMBER 617-9090-003)
LATEST EFFECTIVITY: REV AM

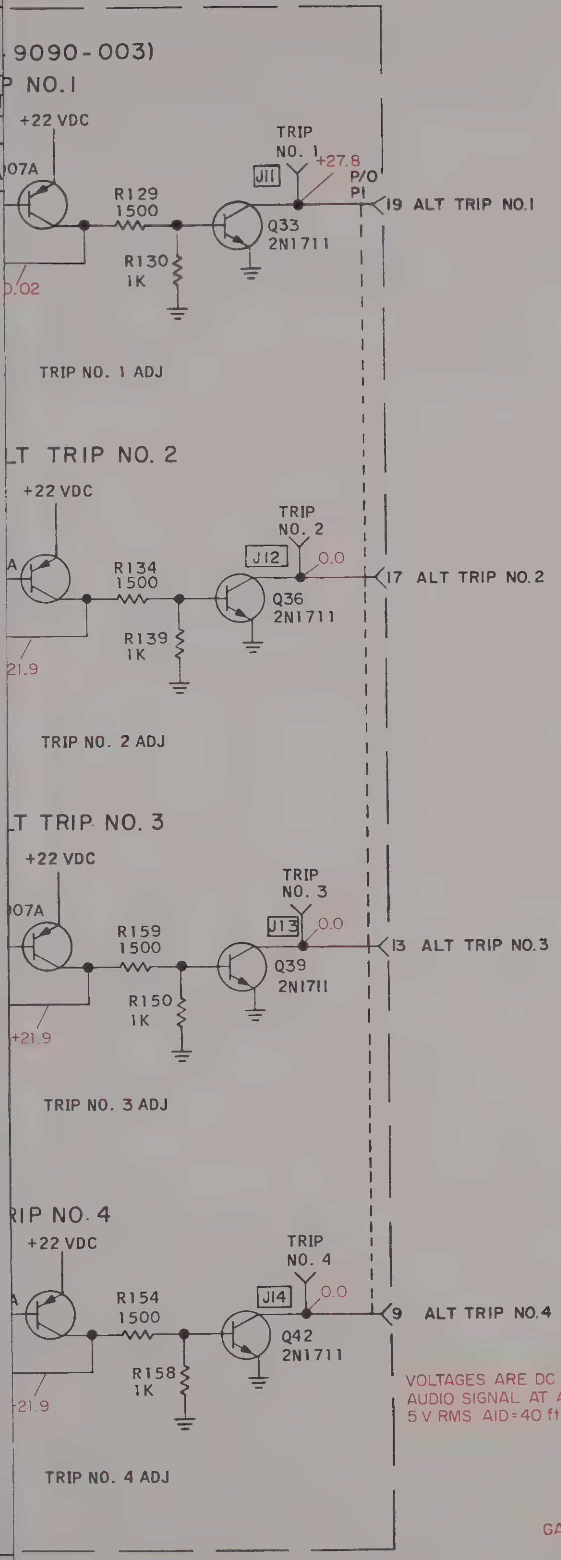
SYMBOL	DESCRIPTION	PART NUMBER
R69	Resistor, fixed, film, 5900Ω, 1%, 1/8W	705-1470-810
R70	Resistor, fixed, composition, 47kΩ, 10%, 1/4W	745-0809-000
R71	Resistor, variable, wire-wound, 5kΩ, 5%, 3/4W	381-1721-120
R72	Resistor, fixed, film, 12.1kΩ, 1%, 1/8W	705-6299-000
R73	Resistor, fixed, film, 10kΩ, 1%, 1/8W	705-6297-000
R74	Resistor, fixed, composition, 39kΩ, 10%, 1/4W	745-0806-000
R75	Resistor, fixed, film, 11.5kΩ, 1%, 1/8W	705-1470-880
R76	Resistor, fixed, composition, 39kΩ, 10%, 1/4W	745-0806-000
R77	Resistor, fixed, composition, 47kΩ, 10%, 1/4W	745-0809-000
R78	Resistor, fixed, film, 20.5kΩ, 1%, 1/8W	705-1470-960
R79	Resistor, fixed, film, 27.4kΩ, 1%, 1/8W	705-1470-990
R80	Resistor, fixed, film, 22.6kΩ, 0.1%, 1/10W	705-5976-160
R81	Resistor, fixed, film, 22.6kΩ, 0.1%, 1/10W	705-5976-160
R82	Resistor, fixed, composition, 1kΩ, 10%, 1/4W	745-0749-000
R83	Resistor, fixed, composition, 180Ω, 10%, 1/2W	745-1321-000
R84	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R85	Resistor, fixed, film, 301Ω, 1%, 1/8W	705-1470-490
R86	Resistor, fixed, film, 25.5kΩ, 1%, 1/8W	705-1468-590
R87	Resistor, fixed, film, 100Ω, 1%, 1/8W	705-1454-150
R88	Resistor, fixed, film, 100Ω, 1%, 1/8W	705-1454-150
R89	Resistor, fixed, film, 14.7kΩ, 1%, 1/8W	705-1454-670
R90	Resistor, fixed, composition, 270kΩ, 10%, 1/4W	745-0836-000
R91	Resistor, fixed, composition, 47kΩ, 10%, 1/4W	745-0809-000
R92	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R93	Resistor, fixed, composition, 100kΩ, 10%, 1/4W	745-0821-000
R94	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R95	Resistor, fixed, composition, 47kΩ, 10%, 1/4W	745-0809-000
R96	Resistor, fixed, composition, 33kΩ, 10%, 1/4W	745-0803-000
R97	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R98	Resistor, fixed, composition, 39kΩ, 10%, 1/4W	745-0806-000
R99	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R100	Resistor, fixed, composition, 3900Ω, 10%, 1/4W	745-0770-000
R101	Resistor, fixed, composition, 1kΩ, 10%, 1/4W	745-0749-000
R102	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R103	Resistor, fixed, composition, 10Ω, 10%, 1/2W	745-1268-000
R104	Resistor, fixed, composition, 8200Ω, 10%, 1/4W	745-0782-000
R105	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R106	Resistor, fixed, composition, 33kΩ, 10%, 1/4W	745-0803-000
R107	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R108	Resistor, fixed, composition, 5600Ω, 10%, 1/4W	745-0776-000
R109	Resistor, fixed, composition, 39kΩ, 10%, 1/4W	745-0806-000
R110	Resistor, fixed, composition, 33kΩ, 10%, 1/4W	745-0803-000
R111	Resistor, variable, wire-wound, 10kΩ, 5%, 3/4W	381-1721-140
R112	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R113	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R114	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R115	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R116	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R117	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R118	Resistor, fixed, composition, 82kΩ, 10%, 1/4W	745-0818-000
R119	Resistor, fixed, composition, 6800Ω, 10%, 1/4W	745-0779-000
R120	Resistor, fixed, composition, 100kΩ, 10%, 1/4W	745-0821-000
R121	Resistor, fixed, composition, 15kΩ, 10%, 1/4W	745-0791-000
R122	Resistor, fixed, composition, 470kΩ, 10%, 1/4W	745-0845-000
R123	Resistor, fixed, composition, 100kΩ, 10%, 1/4W	745-0821-000
R124	Resistor, fixed, composition, 33kΩ, 10%, 1/4W	745-0803-000
R125	Resistor, fixed, composition, 39kΩ, 10%, 1/4W	745-0806-000
R126	Resistor, fixed, composition, 560kΩ, 10%, 1/4W	745-0848-000
R127	Resistor, fixed, composition, 6190Ω, 1%, 1/8W	705-1034-000
R128	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R129	Resistor, fixed, composition, 1500Ω, 10%, 1/2W	745-1359-000
R130	Resistor, fixed, composition, 1kΩ, 10%, 1/4W	745-0749-000
R131	Resistor, fixed, composition, 33kΩ, 10%, 1/4W	745-0803-000
R132	Resistor, fixed, composition, 39kΩ, 10%, 1/4W	745-0806-000
R133	Resistor, fixed, composition, 560kΩ, 10%, 1/4W	745-0848-000
R134	Resistor, fixed, composition, 1500Ω, 10%, 1/2W	745-1359-000
R135	Resistor, fixed, composition, 6190Ω, 1%, 1/8W	705-1034-000
R136	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R137	Resistor, variable, 20kΩ, 5%, 3/4W	381-1721-160
R138	Resistor, variable, 20kΩ, 5%, 3/4W	381-1721-160
R139	Resistor, fixed, composition, 1kΩ, 10%, 1/4W	745-0749-000
R140	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R141	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R142	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R143	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R144	Resistor, fixed, composition, 33kΩ, 10%, 1/4W	745-0803-000
R145	Resistor, fixed, composition, 560kΩ, 10%, 1/4W	745-0848-000
R146	Resistor, fixed, composition, 39kΩ, 10%, 1/4W	745-0806-000
R147	Resistor, fixed, film, 6190Ω, 1%, 1/8W	705-1034-000
R148	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R149	Resistor, variable, 20kΩ, 5%, 3/4W	381-1721-160
R150	Resistor, fixed, composition, 1kΩ, 10%, 1/4W	745-0749-000
R151	Resistor, fixed, composition, 33kΩ, 10%, 1/4W	745-0803-000
R152	Resistor, fixed, composition, 39kΩ, 10%, 1/4W	745-0806-000
R153	Resistor, fixed, composition, 560kΩ, 10%, 1/4W	745-0848-000
R154	Resistor, fixed, composition, 1500Ω, 10%, 1/2W	745-1359-000
R155	Resistor, fixed, film, 6190Ω, 1%, 1/8W	705-1034-000
R156	Resistor, fixed, composition, 10kΩ, 10%, 1/4W	745-0785-000
R157	Resistor, variable, 20kΩ, 5%, 3/4W	381-1721-160
R158	Resistor, fixed, composition, 1kΩ, 10%, 1/4W	745-0749-000
R159	Resistor, fixed, composition, 1500Ω, 10%, 1/2W	745-1359-000
R160	Resistor, fixed, composition, 100Ω, 10%, 1/4W	745-0713-000
R161	Resistor, fixed, composition, 15kΩ, 10%, 1/4W	745-0791-000
R162	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R163	Resistor, fixed, composition, 47kΩ, 10%, 1/4W	745-0809-000
R164	Resistor, fixed, film, 75kΩ, 1%, 1/8W	705-1086-000
R165	Resistor, fixed, film, 1000Ω, 1%, 1/8W	705-1454-150
R166	Resistor, fixed, composition, 22kΩ, 10%, 1/4W	745-0797-000
R167	Resistor, fixed, composition, 27Ω, 10%, 1/4W	745-0692-000
RT1	Resistor, thermal, 50Ω, 10%, 1W	714-1729-000
RT2	Resistor, thermal, 50Ω, 10%, 1W	714-1729-000
U1	Integrated circuit, UA709	351-7141-010
U2	Integrated circuit, UA709	351-7141-010
U3	Integrated circuit, LM101A	351-1040-020
VR1	Zener Diode, 1N754A, 6.8V	353-2716-000
VR2	Not used	
VR3	Zener diode, 1N963A, 12.0V	353-3174-000
VR4	Zener diode, 1N751A, 5.1V (eff to REV AH)	353-2710-000
VR4	Zener diode, 1N4625, 5.1V (eff REV AH)	353-3591-490
VR5	Zener diode, 1N751A, 5.1V (eff to REV AH)	353-2710-000
VR5	Zener diode, 1N4625, 5.1V (eff REV AH)	353-3591-490



VOLTAGES ARE DC AND TAKEN WITH AUDIO SIGNAL AT A2J1, 12,870 Hz AT 5 V RMS AID=40 ft ( )=SELF TEST.

Altitude Processor A1, Schematic Diagram
Figure 6-17 (Sheet 1 of 2)

TEST POINT	TYPICAL WAVEFORM OR NOMINAL VOLTAG
	INPUT: AUDIO SIG AT TO TEST FIXT
	P/O ALT PROCESSOR A
Q31-B	+21.88 V DC
Q31-C	+0.017 V DC
Q32-B	+4.29 V DC
Q32-C	+21.88 V DC
Q33B	+0.0072 V DC
Q33C	+27.85 V DC
Q34B	+21.27 V DC
Q34C	+21.90 V DC
Q35-B	+10.65 V DC
Q35-E	+10.09 V DC
Q35-C	+21.27 V DC
Q36B	+0.7521 V DC
Q36C	0.0 V DC
Q37B	+21.27 V DC
Q37C	+21.9 V DC
Q38-B	+12.18 V DC
Q38-C	+21.27 V DC
Q39B	+0.7489 V DC
Q39C	0.0 V DC
Q40B	+21.27 V DC
Q40C	+21.88 V DC
Q41-E	+13.15 V DC
Q41-B	+13.69 V DC
Q41-C	+21.27 V DC
Q42B	+0.75 V DC
Q42C	+0.039 V DC


9090-003)
P NO.1
+22 VDC
07A
R129 1500
TRIP NO. 1
J11
+27.8
P/O P1
19 ALT TRIP NO.1
Q33 2N1711
R130 1K
0.02
TRIP NO. 1 ADJ
LT TRIP NO. 2
+22 VDC
A
R134 1500
TRIP NO. 2
J12
0.0
17 ALT TRIP NO.2
Q36 2N1711
R139 1K
21.9
TRIP NO. 2 ADJ
LT TRIP NO. 3
+22 VDC
07A
R159 1500
TRIP NO. 3
J13
0.0
13 ALT TRIP NO.3
Q39 2N1711
R150 1K
+21.9
TRIP NO. 3 ADJ
RIP NO. 4
+22 VDC
A
R154 1500
TRIP NO. 4
J14
0.0
9 ALT TRIP NO.4
Q42 2N1711
R158 1K
21.9
TRIP NO. 4 ADJ

VOLTAGES ARE DC AND TAKEN WITH AUDIO SIGNAL AT A2J1, 12,870 Hz 5 V RMS AID=40 ft.

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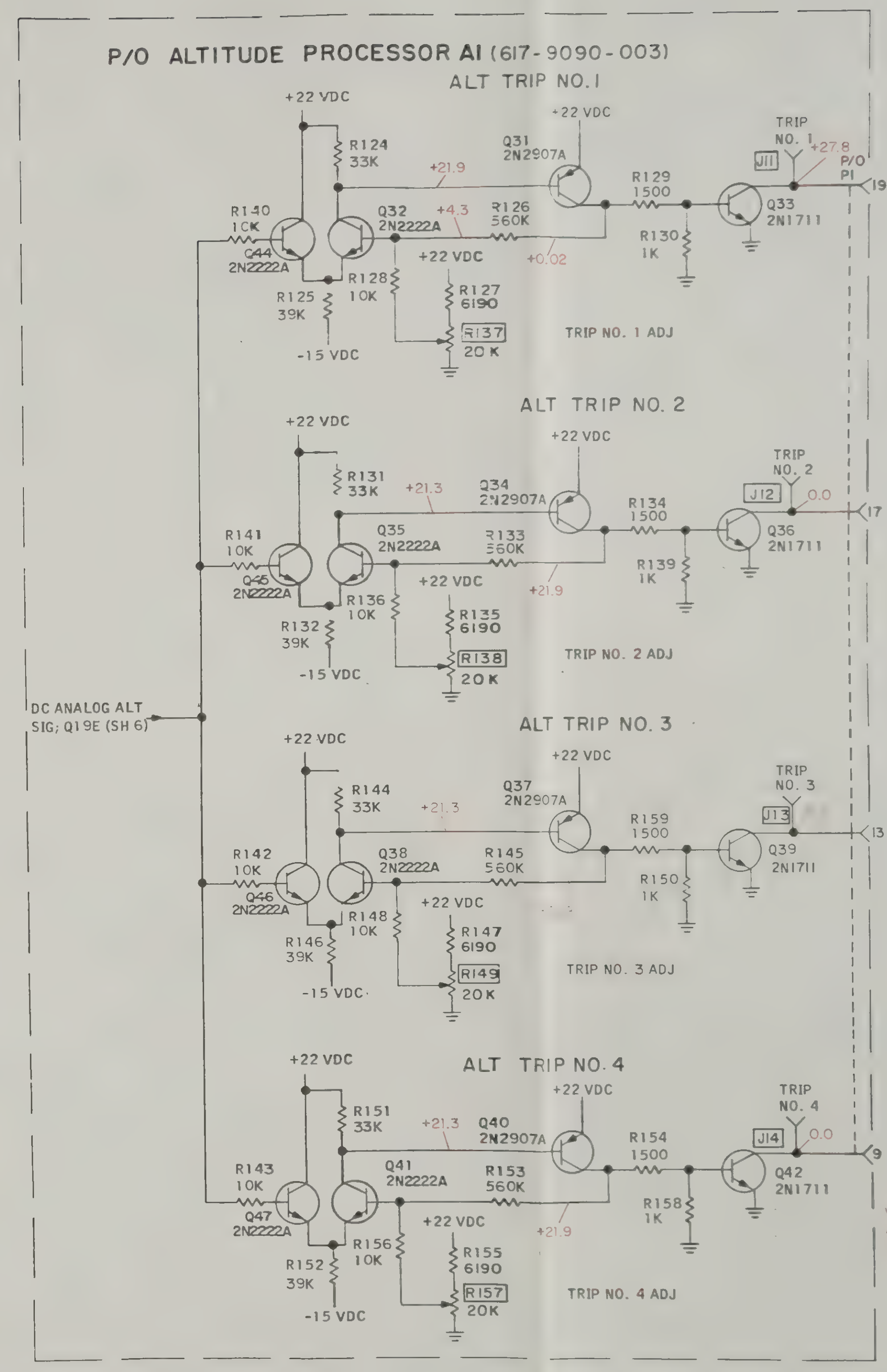
637-2031

Altitude Processor A1, Schematic Diagram
Figure 6-17 (Sheet 2)

TEST POINT	TYPICAL WAVEFORM OR NOMINAL VOLTAGE	TEST POINT	TYPICAL WAVEFORM OR NOMINAL VOLTAGE
	INPUT: AUDIO SIG AT A2J1 -- 12,870 Hz, 5 V RMS OUT OF AUDIO SIG GEN TO TEST FIXTURE INPUT. AID = 40 FT.		
	P/O ALT PROCESSOR A1		P/O ALT PROCESSOR A1
Q31-B	+21.88 V DC	Q44-E	+5.81 V DC
		Q44-B	+6.37 V DC
Q31-C	+0.017 V DC	Q45-B	+6.40 V DC
		Q46-B	+6.40 V DC
		Q46-E	+11.64 V DC
		Q47-B	+6.40 V DC
Q32-B	+4.29 V DC		
Q32-C	+21.88 V DC		
Q33B	+0.0072 V DC		
Q33C	+27.85 V DC		
Q34B	+21.27 V DC		
Q34C	+21.90 V DC		
Q35-B	+10.65 V DC		
Q35-E	+10.09 V DC		
Q35-C	+21.27 V DC		
Q36B	+0.7521 V DC		
Q36C	0.0 V DC		
Q37B	+21.27 V DC		
Q37C	+21.9 V DC		
Q38-B	+12.18 V DC		
Q38-C	+21.27 V DC		
Q39B	+0.7489 V DC		
Q39C	0.0 V DC		
Q40B	+21.27 V DC		
Q40C	+21.88 V DC		
Q41-E	+13.15 V DC		
Q41-B	+13.69 V DC		
Q41-C	+21.27 V DC		
Q42B	+0.75 V DC		
Q42C	+0.039 V DC		

TP4-8445-Q13


P/O ALTITUDE PROCESSOR A1 (617-9090-003)
ALT TRIP NO. 1
ALT TRIP NO. 2
ALT TRIP NO. 3
ALT TRIP NO. 4
+22 VDC
-15 VDC
R124 33K
R140 10K
Q44 2N2222A
Q32 2N2222A
R125 39K
R128 10K
R126 560K
R127 6190
R137 20 K
Q31 2N2907A
R129 1500
R130 1K
Q33 2N1711
J11
TRIP NO. 1
P/O P1
+21.9
+4.3
+0.02
+27.8
TRIP NO. 1 ADJ
19 ALT TRIP NO.1
R131 33K
R141 10K
Q45 2N2222A
Q35 2N2222A
R132 39K
R136 10K
R133 560K
R135 6190
R138 20K
Q34 2N2907A
R134 1500
R139 1K
Q36 2N1711
J12
TRIP NO. 2
+21.3
+21.9
0.0
TRIP NO. 2 ADJ
17 ALT TRIP NO.2
DC ANALOG ALT SIG; Q19E (SH 6)
R144 33K
R142 10K
Q46 2N2222A
Q38 2N2222A
R146 39K
R148 10K
R145 560K
R147 6190
R149 20K
Q37 2N2907A
R159 1500
R150 1K
Q39 2N1711
J13
TRIP NO. 3
+21.3
TRIP NO. 3 ADJ
13 ALT TRIP NO.3
R151 33K
R143 10K
Q47 2N2222A
Q41 2N2222A
R152 39K
R156 10K
R153 560K
R155 6190
R157 20K
Q40 2N2907A
R154 1500
R158 1K
Q42 2N1711
J14
TRIP NO. 4
+21.3
+21.9
0.0
TRIP NO. 4 ADJ
9 ALT TRIP NO.4

VOLTAGES ARE DC AND TAKEN WITH AUDIO SIGNAL AT A2J1, 12,870 Hz 5 V RMS AID=40 ft

GAO-0352-064-0
637-2031

Altitude Processor A1, Schematic Diagram
Figure 6-17 (Sheet 2)

Collins ALT-50 Radio Altimeter System (With ALT-50A for 2,000-Foot Operation)

Rockwell
International

bulletins

Collins General Aviation Division

Printed in USA

523-0766825-004118
4th Edition, 15 January 1988

Service Bulletins and Service Information Letters

(Refer to latest edition/addendum of the General Aviation Equipment Service Bulletin/Information Letter Index 523-0766944 for up-to-date listing.)

SB/SIL Number	*Unit*	*Title*	*Date*
1	ALT-50A	Prevent Momentary Signal Loss at 800 Feet	Mar 15/77
2	ALT-50A	Improve Power Supply Operation	Sep 26/83
1-79	ALT-50A	Altitude Trip Notice Plate	Aug 1/79
1-79, R1			Sep 30/79

NOTICE: This title page replaces third edition title page dated 15 January 1985.

Collins ALT-50 Radio Altimeter System (With ALT-50A for 2,000-Foot Operation)

Rockwell
International

appendix

Collins General Aviation Division

Printed in USA

•523-0775224-001118
1st Edition, 15 January 1988

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Description	***Pages***
Integrated Circuit Descriptions	1 through 4

List of Effective Pages

*The asterisk indicates pages changed, added, or deleted by the current change.

Page No	Issue
Title	15 Jan 88
List of Effective Pages	15 Jan 88
1 thru 4	15 Jan 88

Record of Revisions

RETAIN THIS RECORD IN THE FRONT OF MANUAL.
ON RECEIPT OF REVISIONS, INSERT REVISED PAGES IN THE MANUAL, AND ENTER DATE INSERTED AND INITIALS.

REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED	REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED
1st Ed	15 Jan 88		None				

appendix

INTEGRATED CIRCUIT DESCRIPTIONS

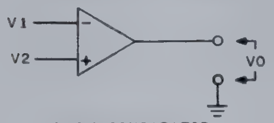
Several types of IC's are used within the ALT-50( ) to enable the unit to perform its various functions. Figures 1 through 3 contain a brief description, functional diagram, and IC logic symbol of IC's used within this unit. An index of the IC's described in this appendix follows:

FIGURE NUMBER	TYPE NUMBER	DESCRIPTION	PAGE NUMBER
1		Basic Opamp Descriptions	2
2	555/556	Astable Triggerable Monostable Multivibrator	3
3	723	Positive/Negative Voltage Regulator	4

DESCRIPTION

OPERATIONAL AMPLIFIERS (OP-AMPS) ARE USED TO ADD, SUBSTRACT, AVERAGE, INTEGRATE AND COMPARE. THE OP-AMP PRODUCES AN OUTPUT WHEN THERE IS A VOLTAGE DIFFERENCE BETWEEN THE TWO INPUT TERMINALS. A POSITIVE GOING SIGNAL AT THE INVERTING INPUT PRODUCES A NEGATIVE GOING OUTPUT SIGNAL, WHEREAS A POSITIVE GOING SIGNAL AT THE NON-INVERTING INPUT PRODUCES A POSITIVE GOING OUTPUT SIGNAL. SHOWN IN FUNCTIONAL DIAGRAMS A THRU G ARE SEVERAL BASIC OP-AMP CONFIGURATIONS.

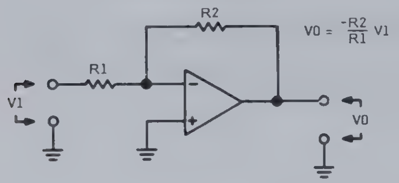
FUNCTIONAL DIAGRAM A



BASIC COMPARATOR

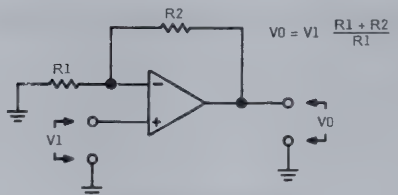
V1	V2	VO
0	0	UNDEFINED
0	1	V +
1	0	V -
1	1	UNDEFINED

FUNCTIONAL DIAGRAM B


R2
R1
V1
VO
VO = -R2/R1 V1

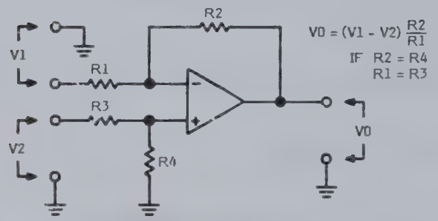
INVERTING AMPLIFIER

FUNCTIONAL DIAGRAM C


R2
R1
V1
VO
VO = V1 (R1 + R2)/R1

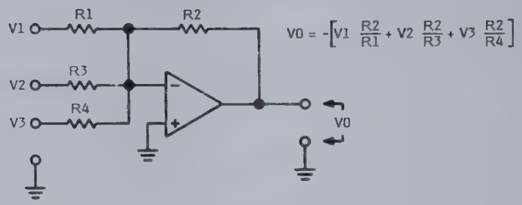
NONINVERTING AMPLIFIER

FUNCTIONAL DIAGRAM D


R2
R1
R3
R4
V1
V2
VO
VO = (V1 - V2) R2/R1
IF R2 = R4
R1 = R3

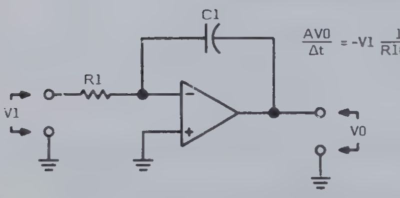
DIFFERENTIAL AMPLIFIER

FUNCTIONAL DIAGRAM E


V1
V2
V3
R1
R2
R3
R4
VO
VO = -[V1 R2/R1 + V2 R2/R3 + V3 R2/R4]

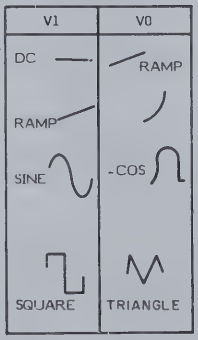
SUMMING INVERTER

FUNCTIONAL DIAGRAM F


C1
R1
V1
VO
AVO/Δt = -V1 1/R1C1

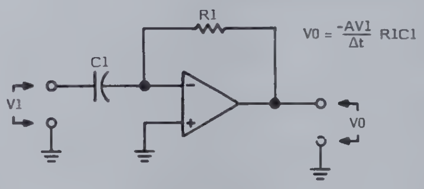
INTEGRATOR

FUNCTION TABLE



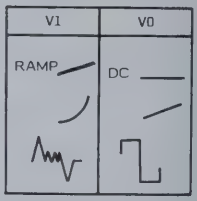
V1	VO
DC	RAMP
RAMP	
SINE	-COS
SQUARE	TRIANGLE

FUNCTIONAL DIAGRAM G


R1
C1
V1
VO
VO = -AV1/Δt R1C1

DIFFERENTIATOR

FUNCTION TABLE

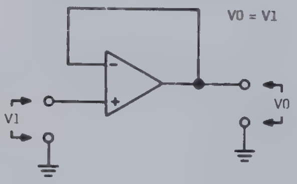


V1	VO
RAMP	DC

COMPENSATION NETWORKS

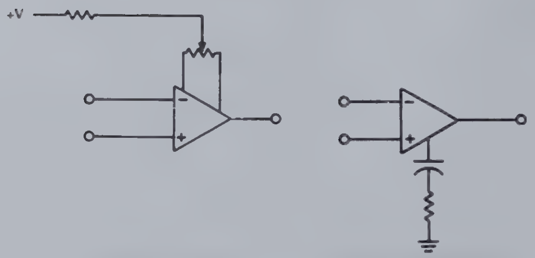
COMPENSATON NETWORKS ARE ADDED TO OP-AMP CIRCUITS TO OFFSET UNDESIRED CHARACTERISTICS. TWO EXAMPLES ARE SHOWN BELOW. OFFSET BALANCING IS REQUIRED IN SMALL SIGNAL APPLICATIONS WHERE VARIATIONS IN THE OP-AMP PARAMETERS MAY CAUSE INPUT DIFFERENCES. PHASE COMPENSATION IS ADDED TO PROVIDE CLOSED LOOP STABILITY TO THE CIRCUIT

FUNCTIONAL DIAGRAM H



VOLTAGE FOLLOWER

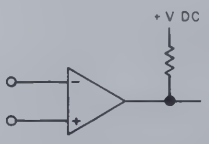
FUNCTIONAL DIAGRAM I



OFFSET BALANCING

PHASE COMPENSATION

FUNCTIONAL DIAGRAM J



OPEN COLLECTOR
OR
OPEN DRAIN
(ACTIVE VO = GROUND)

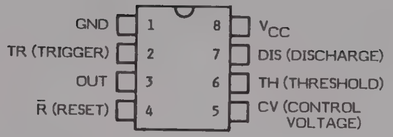
TP6-3693-014-1

Basic Opamp Descriptions
Figure 1

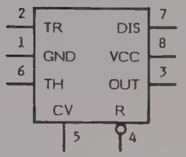
DESCRIPTION

THE 555/556 ARE STABLE CONTROLLERS USED FOR GENERATING ACCURATE TIME DELAYS OR OSCILLATION. IN THE TIME DELAY MODE OF OPERATION, THE TIME IS PRECISELY CONTROLLED BY ONE EXTERNAL RESISTOR AND CAPACITOR. FOR ASTABLE OPERATION AS AN OSCILLATOR, THE FREE-RUNNING FREQUENCY AND DUTY CYCLE ARE ACCURATELY CONTROLLED WITH TWO EXTERNAL RESISTORS AND ONE CAPACITOR. THE CIRCUIT MAY BE TRIGGERED AND RESET ON FALLING WAVEFORMS.

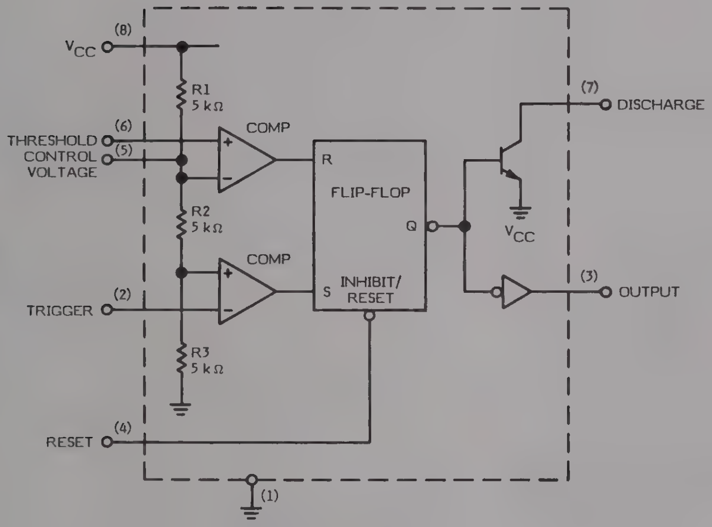
TOP VIEW
555


GND 1
TR (TRIGGER) 2
OUT 3
R̄ (RESET) 4
8 VCC
7 DIS (DISCHARGE)
6 TH (THRESHOLD)
5 CV (CONTROL VOLTAGE)

LOGIC SYMBOL
555

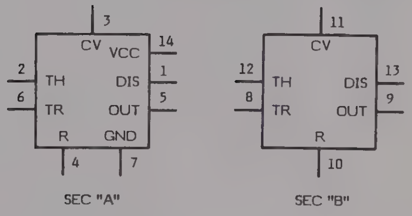

2 TR
1 GND
6 TH
CV 5
DIS 7
VCC 8
OUT 3
R 4

FUNCTIONAL DIAGRAM
555

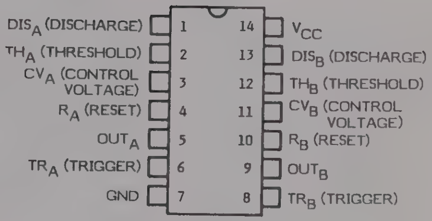

VCC (8)
THRESHOLD (6)
CONTROL VOLTAGE (5)
TRIGGER (2)
RESET (4)
R1 5 kΩ
R2 5 kΩ
R3 5 kΩ
COMP
COMP
R
FLIP-FLOP
Q
S
INHIBIT/ RESET
VCC
(7) DISCHARGE
(3) OUTPUT
(1)

NOTE: THE 556 IS A DUAL VERSION OF THE 555.

LOGIC SYMBOL
556


3 CV
VCC 14
2 TH
DIS 1
6 TR
OUT 5
R 4
GND 7
SEC "A"
11 CV
12 TH
DIS 13
8 TR
OUT 9
R 10
SEC "B"

TOP VIEW
556


DISA (DISCHARGE) 1
THA (THRESHOLD) 2
CVA (CONTROL VOLTAGE) 3
RA (RESET) 4
OUTA 5
TRA (TRIGGER) 6
GND 7
14 VCC
13 DISB (DISCHARGE)
12 THB (THRESHOLD)
11 CVB (CONTROL VOLTAGE)
10 RB (RESET)
9 OUTB
8 TRB (TRIGGER)

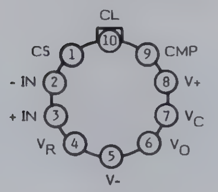
TP6-3721-013

555/556 Astable Triggerable Monostable Multivibrator
Figure 2

DESCRIPTION

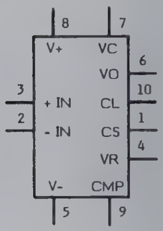
THE 723 IS A MONOLITHIC VOLTAGE REGULATOR THAT CONSISTS OF A TEMPERATURE COMPENSATED REFERENCE AMPLIFIER, ERROR AMPLIFIER, POWER SERIES PASS TRANSISTOR AND CURRENT LIMIT CIRCUITRY. THE 723 IS USED WITH POSITIVE OR NEGATIVE SUPPLIES AS A SERIES, SHUNT, SWITCHING OR FLOATING REGULATOR. THE OUTPUT VOLTAGE IS ADJUSTABLE FROM 2 TO 37 V DC, WITH AN OUTPUT CURRENT UP TO 150 mA.

TOP VIEW
(10-PIN METAL)

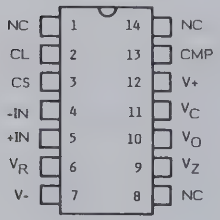

CL
10
CS
1
9
CMP
- IN
2
8
V+
+ IN
3
7
V_C
V_R
4
5
6
V_O
V-

NOTE: PIN 5 CONNECTED TO CASE.

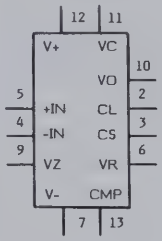
LOGIC SYMBOL
(10-PIN METAL)


8
7
V+
VC
6
VO
10
3
+ IN
CL
1
2
- IN
CS
4
VR
V-
CMP
5
9

TOP VIEW
(14-PIN DIP)

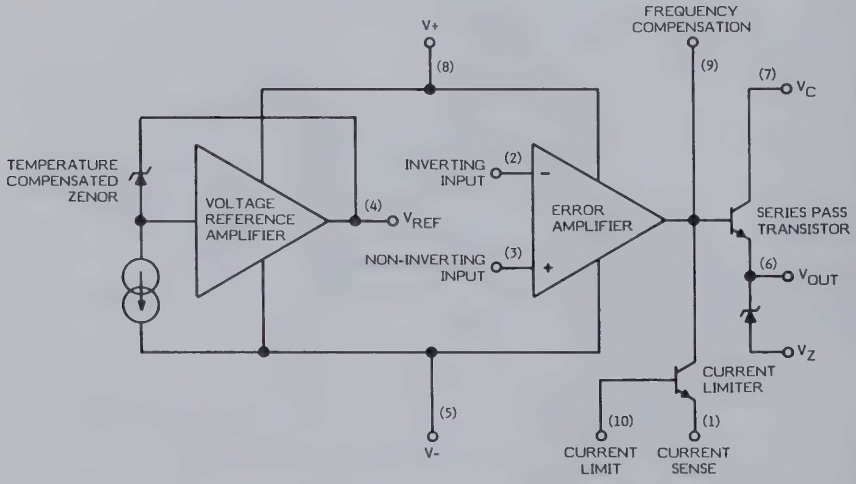

NC
1
14
NC
CL
2
13
CMP
CS
3
12
V+
-IN
4
11
V_C
+IN
5
10
V_O
V_R
6
9
V_Z
V-
7
8
NC

LOGIC SYMBOL
(14-PIN DIP)


12
11
V+
VC
10
VO
2
5
+IN
CL
3
4
-IN
CS
6
9
VZ
VR
V-
CMP
7
13

PIN NAME	DESCRIPTION
CL	CURRENT LIMIT
CS	CURRENT SENSE
CMP	FREQUENCY COMPENSATION
- IN	INVERTING INPUT
+ IN	NON-INVERTING INPUT
V_R	VOLTAGE REFERENCE
V_O	VOLTAGE OUT
V_C	12 VOLTS
NC	NO CONNECTION

FUNCTIONAL BLOCK DIAGRAM


V+
(8)
FREQUENCY COMPENSATION
(9)
(7)
V_C
TEMPERATURE COMPENSATED ZENOR
VOLTAGE REFERENCE AMPLIFIER
(4)
V_{REF}
INVERTING INPUT
(2)
-
ERROR AMPLIFIER
NON-INVERTING INPUT
(3)
+
SERIES PASS TRANSISTOR
(6)
V_{OUT}
V_Z
CURRENT LIMITER
(5)
V-
(10)
CURRENT LIMIT
(1)
CURRENT SENSE

NOTE: PIN NUMBERS REFER TO 10-PIN METAL CAN PACKAGE.

TP6-3699-013

723 Positive/Negative Voltage Regulator
Figure 3

Collins 339H-4/4A Radio Altitude Indicator

Rockwell
International

description

Collins General Aviation Division

Printed in USA

523-0764965-005118
5th Edition, 15 January 1988

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5. Mechanical Description 1

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7.2.2 Decision Height (DH) Circuit 12
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7.2.4 Self-Test Circuit 14

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NOTICE: This section replaces fourth edition dated 15 January 1985.

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*The asterisk indicates pages changed, added, or deleted by the current change.

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1st Ed	1 Nov 73						
2nd Ed	1 Dec 74						
1	30 Jun 76		None				
2	1 Aug 77		339H-4: 1, 2, 3, 4 339H-4/4A: 1, 2, 3, 4, 5				
3rd Ed	15 Feb 80		339H-4: 5 339H-4A: 6				
4th Ed	15 Jan 85		None				
5th Ed	15 Jan 88		None				

1. GENERAL

The 339H-4/4A Radio Altitude Indicator is one of the display and control units of the ALT-50 Radio Altimeter System. The 339H-4 is used in fixed-wing aircraft, and the 339H-4A is used in helicopters.

2. PURPOSE OF EQUIPMENT

The 339H-4/4A Radio Altitude Indicator provides the pilot with a visual display of the aircraft height above the terrain during the critical approach phase of the flight. The indicator provides the pilot with selection of a decision height and an indication when the aircraft descends to the selected decision height. A self-test switch provides the pilot with the capability of testing the ALT-50 Radio Altimeter System, excluding antennas. Refer to figure 1 for an illustration of the 339H-4 and the 339H-4A Radio Altitude Indicators. Table 1 is a list of equipment covered.

3. SPECIFICATIONS

Table 2 is a list of specifications for the 339H-4/4A Radio Altitude Indicator.

4. PHYSICAL DESCRIPTION

The location and shape of the pointer, altitude scale dial, decision height (DH) index, DH indicator, DH knob, flag, and TEST switch are shown in figure 2.

The scale dial is matte black with semigloss white calibration marks and numerals. The pointer is matte black with a fluorescent ARC yellow tip. The DH index is fluorescent lightning yellow and the warning flag is fluorescent fire orange. The mask assemblies are matte black.

The scale dial is wedge-lighted using blue-white lamps. The DH indicator is yellow plastic with DH embossed in black. The TEST switch is white plastic. The DH knob is matte black with the DH index symbol embossed on the front in fluorescent lightning yellow.

5. MECHANICAL DESCRIPTION

The indicator is constructed to meet or exceed the environmental conditions encountered in general aviation aircraft.

The indicator is housed in an ATI 3 nonpressurized case (dust cover) that measures 3.175 inches (8.065 cm) square. The dust cover length, measured from the rear of the mounting flange to the rear of the dust cover, is 4.520 inches (11.481 cm) maximum. The indicator is front- or rear-mounted in the cockpit control panel and weighs 1.5 pounds (0.68 kg) maximum. Refer to the outline and mounting diagram in the installation section of this instruction book for mounting instructions. The bezel is 3.375 inches (8.573 cm) square and contains a lighting wedge that serves as the dial window. The lighting wedge is coated with a high-efficiency, antireflective (HEA) coating that reduces glare.

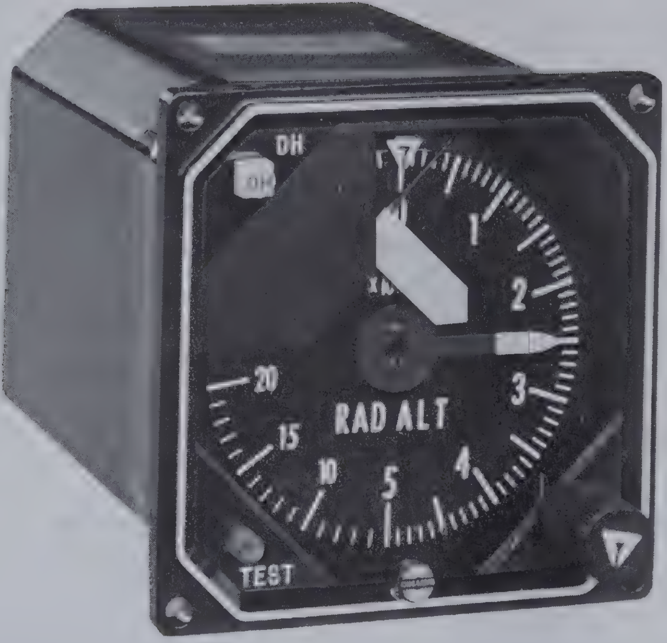
The indicator is sealed to prevent dust and moisture damage to the internal components. The indicator bezel and dust cover colors are listed in table 2.

The bezel, bearing plate, motor mounting plate, and connector plate are supported in a stack assembly. Terminal boards A1 and A2 are installed on the support posts between the motor mounting plate and the connector plate.

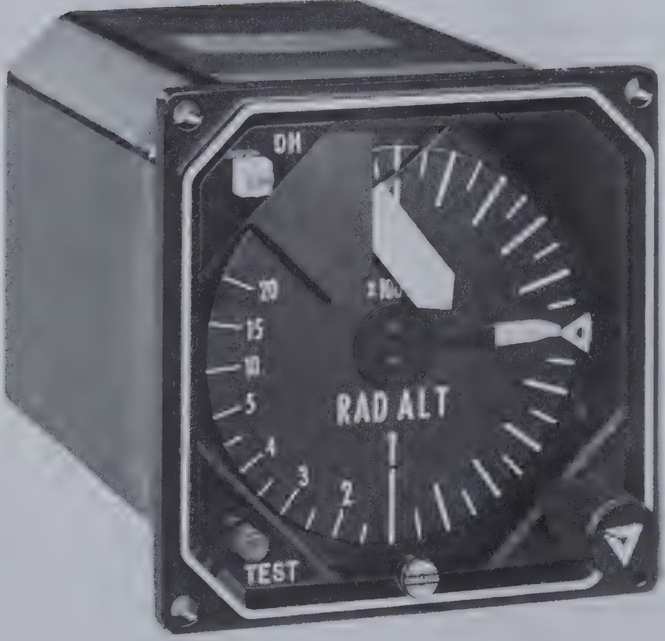
The indicator is designed to provide good readability from the following viewing angles:

a. 45 degrees from above a normal to the top edge of the dial window.
b. 30 degrees from the side of a normal to the right or left edge of the dial window.
c. 0 degree from a normal to the bottom edge of the dial window (straight-on view).

All electrical connections are made through a 19-pin connector on the rear of the indicator.


DH
DH
1
2
3
4
5
10
15
20
RAD ALT
TEST

A-339H-4


DH
DH
20
15
10
5
4
3
2
1
RAD ALT
TEST

B-339H-4A

TP3- 6755-019

339H-4/4A Radio Altitude Indicator
Figure 1

Table 1. Equipment Covered.

EQUIPMENT TYPE	DESCRIPTION	COLLINS PART NUMBER (CPN)
339H-4	Radio altitude indicator. -20- to +2,000-ft altitude scale calibrated for fixed-wing aircraft. Gray bezel (flat) and +28-V dc blue-white lighting.	622-1204-001
339H-4	Radio altitude indicator. -20- to +2,000-ft altitude scale calibrated for fixed-wing aircraft. Gray bezel (flat) and +5-V dc blue-white lighting.	622-1204-002
339H-4	Radio altitude indicator. -20- to +2,000-ft altitude scale calibrated for fixed-wing aircraft. Black bezel (with raised bright metal trim ring) and +28-V dc blue-white lighting.	622-1204-003
339H-4	Radio altitude indicator. -20-to +2,000-ft altitude scale calibrated for fixed-wing aircraft. Black bezel (with raised bright metal trim ring) and +5-V dc blue-white lighting.	622-1204-004
339H-4	Radio altitude indicator. -20- to +2,000-ft altitude scale calibrated for fixed-wing aircraft. Gray bezel (with raised bright metal trim ring) and +28-V dc blue-white lighting.	622-1204-005
339H-4	Radio altitude indicator. -20- to +2,000-ft altitude scale calibrated for fixed-wing aircraft. Gray bezel (with raised bright metal trim ring) and +5-V dc blue-white lighting.	622-1204-006
339H-4	Radio altitude indicator. -20- to +2,000-ft altitude scale calibrated for fixed-wing aircraft. Gray bezel (with raised painted metal trim ring) and +5-V dc blue-white lighting.	622-1204-007
339H-4	Radio altitude indicator. -20- to +2,000-ft altitude scale calibrated for fixed-wing aircraft. Black bezel (with raised bright metal trim ring) and +5-V dc blue-white lighting. (For U.S. Coast Guard MRS Program.)	622-1204-008
339H-4	Radio altitude indicator. -20- to +2,000-ft altitude scale calibrated for fixed-wing aircraft. Black bezel (with raised bright metal trim ring and sloping portion of bezel painted gray) and +5-V dc blue-white lighting.	622-1204-010
339H-4A	Radio altitude indicator. -20- to +2,000-ft altitude scale calibrated for helicopters. Gray bezel (flat) and +28-V dc blue-white lighting.	622-1205-001
339H-4A	Radio altitude indicator. -20- to +2,000-ft altitude scale calibrated for helicopters. Gray bezel (flat) and +5-V dc blue-white lighting.	622-1205-002
339H-4A	Radio altitude indicator. -20- to +2,000-ft altitude scale calibrated for helicopters. Black bezel (with raised bright metal trim ring) and +28-V dc blue-white lighting.	622-1205-003
339H-4A	Radio altitude indicator. -20- to +2,000-ft altitude scale calibrated for helicopters. Black bezel (with raised bright metal trim ring) and +5-V dc blue-white lighting.	622-1205-004
339H-4A	Radio altitude indicator. -20- to +2,000-ft altitude scale calibrated for helicopters. Gray bezel (with raised bright metal trim ring) and +28-V dc blue-white lighting.	622-1205-005
339H-4A	Radio altitude indicator. -20- to +2,000-ft altitude scale calibrated for helicopters. Gray bezel (with raised bright metal trim ring) and +5-V dc blue-white lighting.	622-1205-006

Table 2. Equipment Specifications.

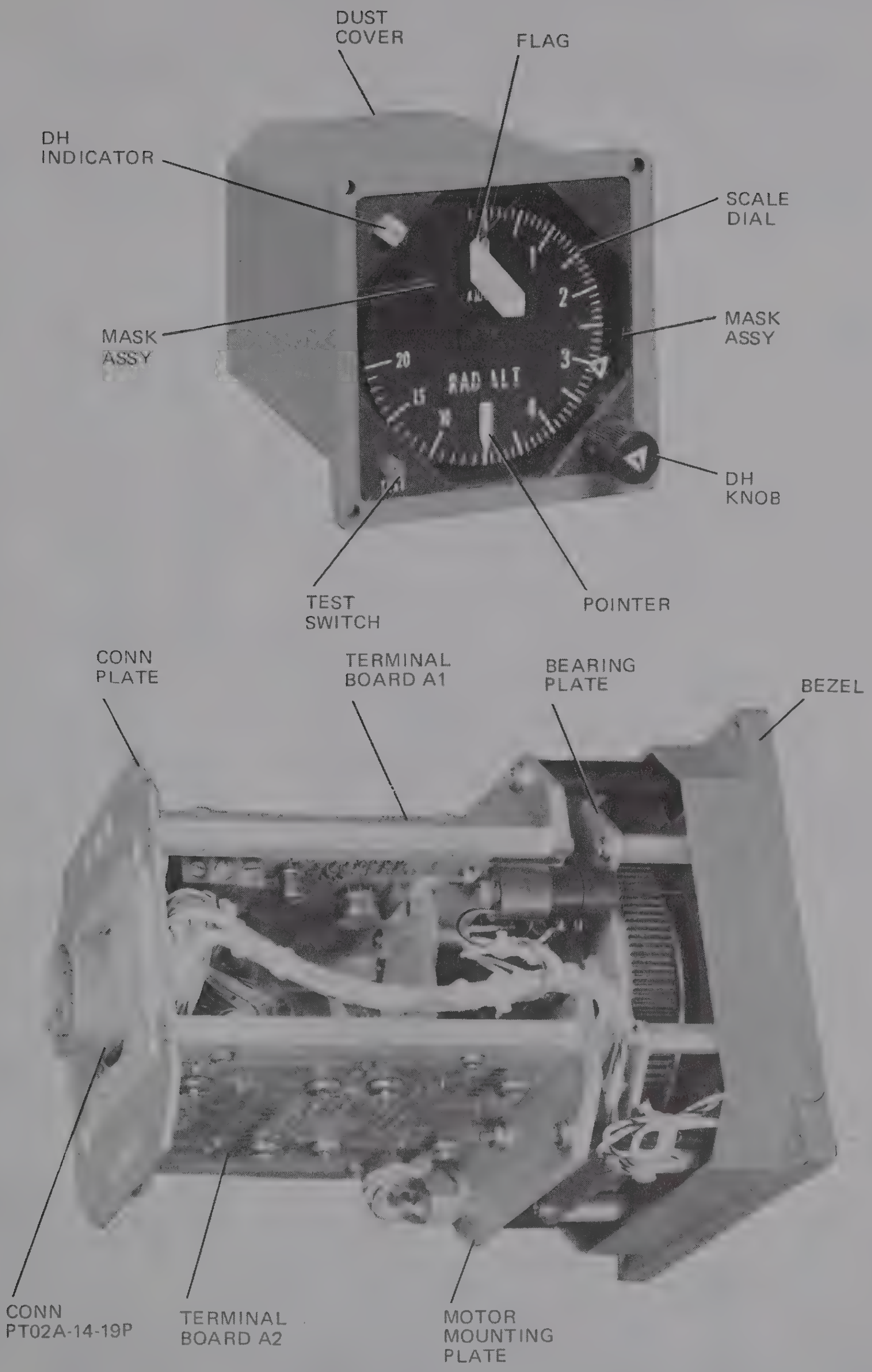
CHARACTERISTIC	SPECIFICATION
Applicable specifications	
TSO	C-87
RTCA document	DO-138, DO-123
ARINC specification	408
FCC rules	Part 87
Environmental categories	DO-138, DAPAAAXXXXXX
Environmental specifications	
Temperature range	
Operation	-15 to +55 °C (+5 to +131 °F), category D
Storage	-65 to +71 °C (-85 to 159.8 °F)
Service altitude range	-1,000 to 50,000 feet (-304.8 to 15,240.0 m), category D
Absolute pressure	Equivalent to 50 inches (127 cm) of mercury without damage
Magnetic effect	5 degrees maximum delfection of a 1-1/2-inch (3.81 cm) bar magnet at a distance of 12 inches (30.48 cm)
Vibration	In accordance with DO-138, category P
Relative humidity	
+71 °C (+160 °F)	95 percent, maximum
+38 °C (+100 °F)	85 percent, maximum
Shock	
Operational	6 g
Crash safety	15 g (10 ms duration)
Electrical specifications	
Altitude range	-20 to 2,000 feet
Altitude accuracy	
339H-4	
-20 to 150 feet	±3 feet
150 to 500 feet	±2.0 percent of indicated altitude
500 to 2,000 feet	±3.5 percent of indicated altitude

Table 2. Equipment Specifications (Cont).

CHARACTERISTIC	SPECIFICATION
339H-4A	
0 to 100 feet	±3 feet
100 to 500 feet	±3.5 percent of indicated altitude
500 to 2,000 feet	±5.0 percent of indicated altitude
Decision height altitude range	0 to 2,000 feet
Decision height accuracy with decreasing altitude	
339H-4	
Below 500 feet	Decision height ±10 feet
Above 500 feet	Decision height ±60 feet
339H-4A	
Below 100 feet	Decision height ±3 feet
100 to 500 feet	Decision height ±15 feet
Above 500 feet	Decision height ±150 feet
Power requirements	
Positive reference voltage	+22 V dc ±0.5 percent regulated, 0.055 A maximum
Negative reference voltage	-15 V dc ±0.5 percent regulated, 0.025 A maximum
DH supply	+27.5 V dc ±10 percent, 0.250 A maximum
DH indicator	28 V ac or V dc ±10 percent, 0.050 A maximum, continuous
Lighting	
339H-4	
622-1204-001, -003, -005	+28 V dc ±10 percent, 0.120 A maximum
622-1204-002, -004, -006, -007, -008, -010	+5 V dc ±10 percent, 0.460 A maximum
339H-4A	
622-1205-001, -003, -005	+28 V dc ±10 percent, 0.120 A maximum
622-1205-002, -004, -006	+5 V dc ±10 percent, 0.460 A maximum

Table 2. *Equipment Specifications (Cont).*

CHARACTERISTIC	SPECIFICATION
Input signal requirements	
Dc analog altitude signal	
-20 to 500 feet	20 millivolts per foot
501 to 2,000 feet	+10.4 V dc +3 millivolts per foot
Off-scale bias	
Signal	+18.0 ±0.5 V dc, +18.5 V dc maximum
Input impedance	150 kilohms minimum
Warning flag signal	
Nominal	+22.0 V dc
Valid flag	+18.5 to +24.0 V dc
Invalid flag	0 to +3.5 V dc
Input impedance	1 kilohm minimum
Output signals	
External decision height	Isolated pair of relay contacts for switching external circuit
Relay contact loads, continuous	28 V dc, 0.100 A maximum
	5 V ac, 0.500 A maximum
	26 V ac, 0.250 A maximum
	115 V ac, 0.100 A maximum
Functional test signal	Ground
Bezel and dust cover color	
339H-4	Black
622-1204-003, -004, -008	
339H-4A	
622-1205-003, -004	
339H-4	Gray
622-1204-001, -002, -005, -006, -007	
339H-4A	
622-1205-001, -002, -005, -006	
339H-4	Black-gray bezel and gray dust cover
622-1204-010	


DUST COVER
FLAG
DH INDICATOR
SCALE DIAL
MASK ASSY
MASK ASSY
DH KNOB
TEST SWITCH
POINTER
RAD ALT
CONN PLATE
TERMINAL BOARD A1
BEARING PLATE
BEZEL
CONN PT02A-14-19P
TERMINAL BOARD A2
MOTOR MOUNTING PLATE

TP3-6756-017

Assembly and Parts Identification, Typical
Figure 2

On the 339H-4 indicator, the scale dial is calibrated from 0 to 2,000 feet. The 0- to 500-foot portion of the scale covers 180 degrees and major altitude marks are at 100-foot intervals with minor altitude marks at 10-foot intervals. The 500 to 2,000-foot portion of the scale covers the next 81 degrees and major altitude marks are at 500-foot intervals with minor altitude marks at 100-foot intervals. The altitude scale measures 2.550 inches (6.48 cm) in diameter. Numerals 0, 1, 2, 3, 4, and 5 are 0.218 inch (5.54 mm) high and numerals 10, 15, and 20 are 0.156 inch (3.96 mm) high.

On the 339H-4A indicator, the scale dial is calibrated from 0 to 2,000 feet. The 0- to 100-foot portion of the scale covers 180 degrees and major altitude marks are at 10-foot intervals. The 100- to 500-foot portion of the scale covers the next 72.45 degrees and major altitude marks are at 100-foot intervals with minor altitude marks at 50-foot intervals. The 500- to 2,000-foot portion of the scale covers the next 40.75 degrees, and major altitude marks are at 500-foot intervals. The altitude scale measures 2.550 inches (6.48 cm) in diameter. Numerals 0 and 1 are 0.200 inch (5.08 mm) high, and numeral 2 is 0.150 inch (3.81 mm) high. Numerals 3, 4, 5, 10, 15, and 20 are 0.125 inch (3.18 mm) high.

6. ELECTRICAL DESCRIPTION

The indicator provides a visual readout of the aircraft altitude above the terrain during the critical approach phase of the flight. The electrical portion of the indicator is completely solid state. The pointer is driven by servo loop operation. The majority of the electronic circuits are contained on terminal boards A1 and A2. Terminal board A1 contains the comparator and flag circuits and terminal board A2 contains the servo loop drive circuits. The remaining electrical components, including the servo-motor, DH light and switch, instrument lights, self-test switch, feedback potentiometer, and the warning flag meter mechanism, are part of the indicator subassembly.

7. PRINCIPLES OF OPERATION

7.1 Functional Theory of Operation (Refer to figure 3.)

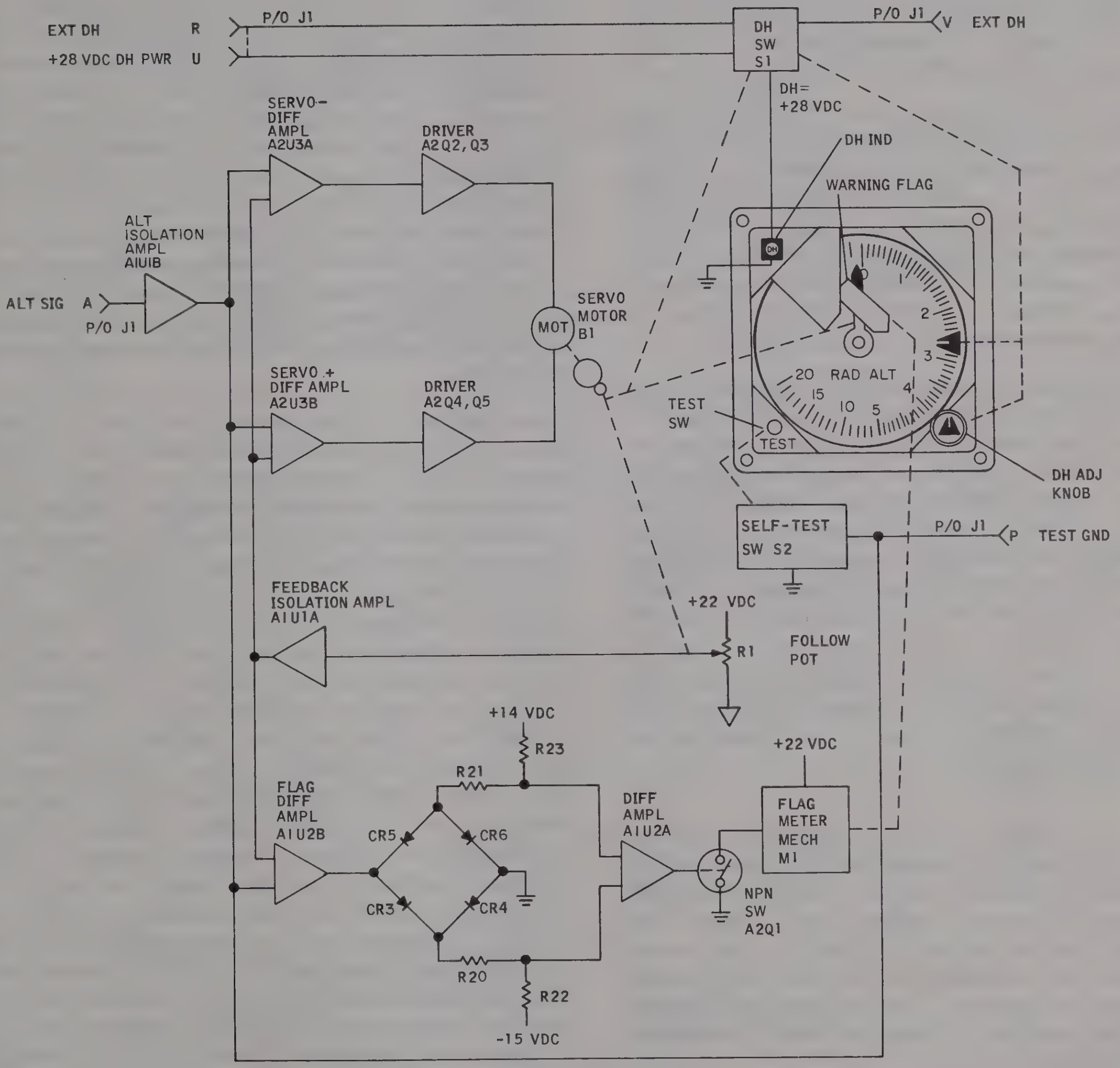
The dc analog altitude voltage, proportional to the aircraft altitude above the terrain, is applied from the radio altimeter receiver-transmitter to altitude isolation amplifier A1U1B. A feedback voltage, that is proportional to the altitude indicated by the pointer, is applied from follow potentiometer R1 to feedback isolation amplifier A1U1A.

Follow potentiometer R1, feedback isolation amplifier A1U1A, servo differential amplifiers A2U3A and A2U3B, drivers A2Q2, Q3 and A2Q4, Q5, and servo motor B1 form a servo loop.

The isolation amplifiers apply the altitude and feedback voltages to servo-differential amplifier A2U3B and servo-differential amplifier A2U3A. When the aircraft altitude increases, the altitude voltage exceeds the feedback voltage and the servo plus differential amplifier applies a plus voltage through driver A2Q4, Q5 to servo motor B1. The servo-differential amplifier applies a minus voltage to driver A2Q2, Q3. Driver A2Q2, Q3 applies a ground to servo motor B1 causing B1 to rotate in a direction that increases the altitude indicated by the pointer. Servo motor B1 is mechanically coupled to the pointer, DH switch S1, and follow potentiometer R1. When level flight is attained, within the indicator range, the inputs to the differential amplifiers are equal in amplitude and the servo motor is nulled. The pointer remains at the indicated altitude.

When the aircraft descends, the feedback voltage exceeds the altitude voltage and the servo-differential amplifier applies a plus voltage through driver A2Q2, Q3 to servo motor B1. The servo-differential amplifier applies a minus voltage to driver A2Q4, Q5. Driver A2Q4, Q5 applies a ground to servo motor B1 and the servo motor rotates in a direction that decreases the altitude indicated by the pointer.

When the feedback voltage is within a nominal 150 millivolts of the altitude voltage, indicating that the feedback voltage is tracking the altitude voltage, the inputs to flag differential amplifier A1U2B cause the amplifier to produce a zero (null) output that is applied to A1CR3 and CR5. Diodes A1CR4 and CR6 are forward biased and the inputs to differential amplifier A1U2A cause the amplifier to apply a plus voltage to transistor switch A1Q1. Transistor A1Q1 turns on and applies a ground to flag meter mechanism M1. Meter mechanism M1 energizes and pulls the warning flag out of view.


EXT DH
R
+28 VDC DH PWR
U
P/O J1
DH
SW
S1
P/O J1
V
EXT DH
DH=
+28 VDC
SERVO-
DIFF
AMPL
A2U3A
DRIVER
A2Q2, Q3
DH IND
WARNING FLAG
ALT
ISOLATION
AMPL
A1U1B
ALT SIG
A
P/O J1
MOT
SERVO
MOTOR
B1
DH
0
1
2
3
4
5
10
15
20
RAD ALT
SERVO +
DIFF AMPL
A2U3B
DRIVER
A2Q4, Q5
TEST
SW
TEST
DH ADJ
KNOB
SELF-TEST
SW S2
P/O J1
P
TEST GND
FEEDBACK
ISOLATION AMPL
A1U1A
+22 VDC
R1
FOLLOW
POT
+14 VDC
R23
R21
+22 VDC
FLAG
DIFF
AMPL
A1U2B
CR5
CR6
DIFF
AMPL
A1U2A
FLAG
METER
MECH
M1
CR3
CR4
NPN
SW
A2Q1
R20
R22
-15 VDC

TP3-6995-014

Functional Diagram
Figure 3

During aircraft descent, if the feedback voltage does not track the altitude voltage within 150 millivolts, amplifier A1U2B produces a plus voltage that is applied to A1CR3 and CR5. Diode CR5 is reverse biased and CR3 is forward biased, causing the negative input to A1U2A to be removed. Amplifier A1U2A applies a minus voltage to A1Q1, and transistor Q1 turns off removing the ground from M1. Meter mechanism M1 deenergizes and the warning flag comes into view.

During aircraft ascent, if the feedback voltage does not track the altitude voltage within 150 millivolts, amplifier A1U2B produces a minus voltage that is applied to A1CR3 and CR5. Diode CR3 is reverse biased and CR5 is forward biased, causing the positive input to A1U2A to be removed. Amplifier A1U2A applies a negative voltage to A1Q1 and Q1 turns off causing the warning flag to come in view.

The DH knob is mechanically coupled to the DH index and DH switch S1. The DH knob is manually adjusted to set the DH index on the selected decision height and to set the DH switch to the correct position for the selected decision height. When the aircraft descends to the decision height, DH switch S1 closes and applies +28 V dc to the DH indicator causing the indicator to light. Closing of DH switch S1 applies the external DH input at J1-R to the external DH output at J1-V. During climbout, hysteresis in the DH switch causes the DH indicator to remain lit until the aircraft is 10 to 20 feet above the selected decision height.

When the TEST switch is pressed, self-test switch S2 applies a ground to J1-P and to flag differential amplifier A1U2B. Amplifier A1U2B produces a minus voltage that causes the warning flag to come in view. The ground applied to J1-P causes the ALT-50A or 860F-2 Radio Altimeter to produce a 50-foot self-test altitude signal, and a 50-foot altitude indication is displayed on the indicator.

7.2 Detailed Theory of Operation (Refer to figure 1 in the 339H-4/4A Radio Altitude Indicator diagrams section.)

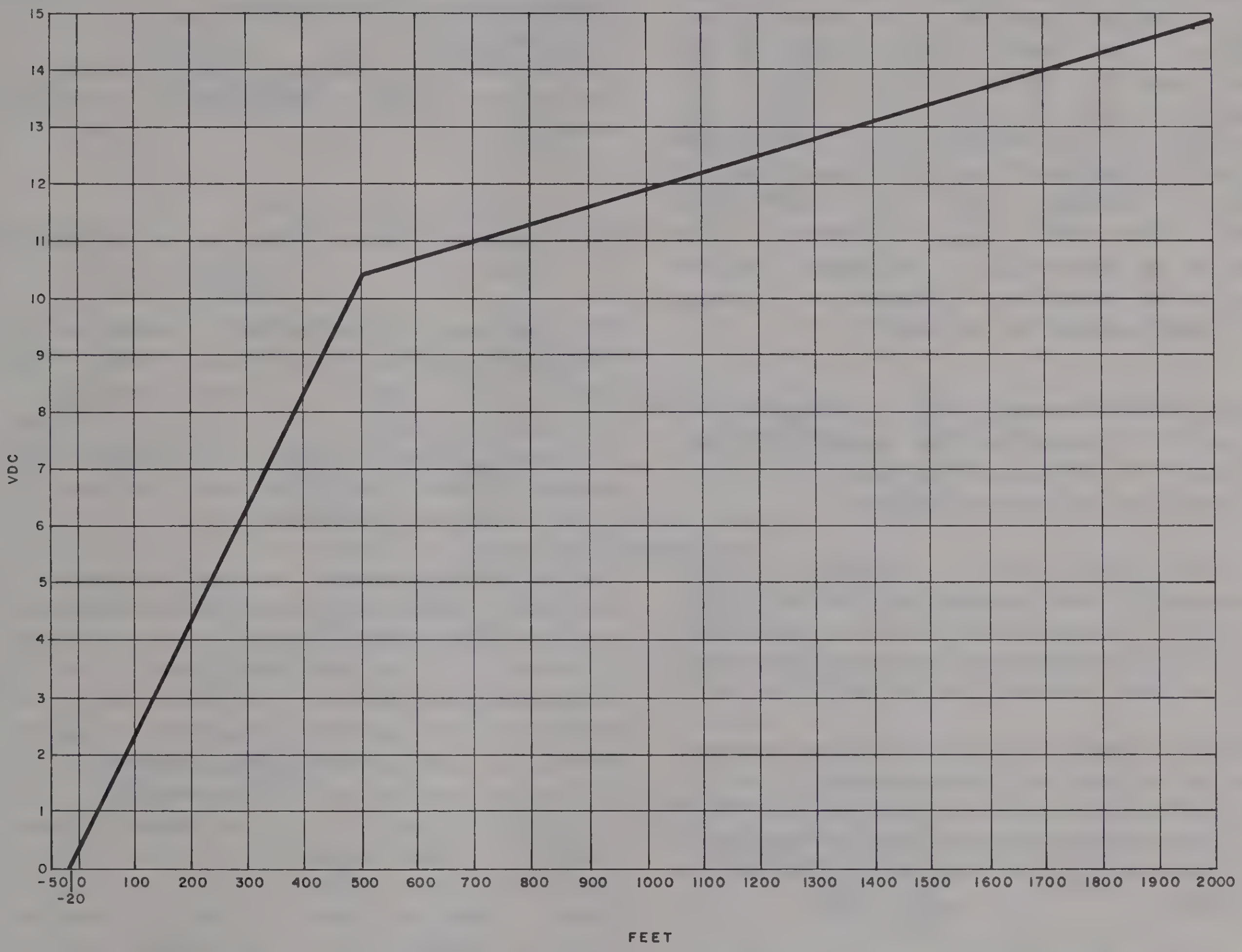
7.2.1 Altitude Indication Circuit

The dc analog altitude voltage from the ALT-50A or 860F-2 Radio Altimeter is applied to rear connector J1-A and J1-B. The voltage is proportional to the aircraft altitude above the terrain. The analog is piecewise linear (20 millivolts per foot from 0 to 500 feet, and 3 millivolts per foot from 500 to 2,000 feet). Refer to figure 4.

The dc altitude voltage is applied from J1-A through A1R13 to the noninverting input of A1U1B. A nominal +11-V dc reference voltage is applied from voltage divider A1R6, R7 through A1R11 to the inverting input of U1B, through A1R10 to the inverting input of U1A, through A1R12 to the noninverting input of U1B, and through R9 to the noninverting input of U1A. The bias voltage increases the reference level of the inputs to prevent the output of U1A and U1B from dropping to less than a nominal +2 V dc. Operational amplifier U1B operates as a scaling isolation amplifier with a gain less than one. The output of U1B is applied through A2R34 to the noninverting input of A2U3B, through A2R29 to the inverting input of A2U3A, and through A1R17 to the inverting input of A1U2B.

The pointer is mechanically coupled to servo motor B1 and follow potentiometer R1. The wiper of R1 is positioned by the servo motor to produce a dc analog feedback voltage proportional to the altitude indicated by the pointer. The feedback voltage is equal to the dc analog altitude voltage for the same altitude. On 339H-4 indicators, variable resistor A1R2 is used to adjust the high altitude feedback voltage to the correct analog voltage. On 339H-4A indicators, variable resistor A1R2 is used to adjust the high altitude feedback voltage to the correct dc analog voltage, variable resistor A1R4 is used to adjust the 0-foot feedback voltage, and variable resistor A1R3 is used to adjust the 100-foot feedback voltage. The feedback voltage is applied from the wiper of R1 through A1R8 to the noninverting input of A1U1A. Capacitor A1C1 speeds up the input to A1U1A. Operational amplifier A1U1A operates as a scaling isolation amplifier the same as described for A1U1B. The output of A1U1A is applied through A2R30 to the noninverting input of A2U3A, through A2R33 to the inverting input of A2U3B, and through A1R16 to the noninverting input of A1U2B.

Operational amplifiers A2U3A and U3B operate as differential amplifiers and compare the dc altitude and feedback voltages. In the quiescent state and with no altitude voltage input, the input to the noninverting and inverting inputs of U3A and U3B is a nominal +14 V dc. The equal inputs cause drivers



NOTE:

ANALOG PLOTTED USING THE FOLLOWING FORMULAS:

0 TO 500 FT;
$V = 0.4 + (0.02 \times H)$

500 TO 2000 FT;
$V = 10.4 + [0.003 \times (H - 500)]$

TP3-2084-011

DC Analog Altitude Signal, Voltage Chart
Figure 4

A2Q2, Q3 and A2Q4, Q5 to produce a nominal +14 V dc that is applied to both sides of servo motor B1. Servo motor B1 is nulled and does not drive in either direction.

During aircraft descent, the feedback voltage exceeds the altitude voltage, the U3A output is more positive, and the U3B output is less positive. The forward bias of A2Q2 is increased and the forward bias of A2Q3 is decreased, causing the output from driver circuit A2Q2, Q3 to increase. The forward bias of A2Q4 is decreased and the forward bias of A2Q5 is increased causing the output from driver circuit A2Q4, Q5 to decrease. The input to the servo motor is unbalanced and the servo motor drives in a direction to decrease the altitude indicated by the pointer.

During aircraft ascent, A2U3A, U3B, Q2, Q3, Q4, and Q5 operate in the opposite direction and cause the servo motor to rotate in a direction to increase the indicated altitude.

An altitude clamp circuit is installed in current production 339H-4/4A units and may also be installed (if required) by a service bulletin in older units. Refer to the 339H-4/4A schematic diagram in the diagrams section of this instruction book for effectivity.

The altitude signal from the radio altimeter increases as the aircraft ascends. When the aircraft altitude exceeds 2,000 feet, the radio altimeter provides +18-V dc off-scale output that causes the altitude pointer on the indicator to be driven out of view behind the display mask.

The radio altimeter off-scale output can cause operational amplifier A1U1B to provide an output that results in continuous drive to servo motor B1. This can result in excessive wear on certain gears in the pointer drive train.

The altitude clamp circuit consists of resistors A1R38, R39 and transistor A1Q6. The +22-V dc reference voltage is applied to voltage divider A1R38, R39. The voltage at the junction of A1R38, R39 (approximately +13.5 V dc) is applied to the base of A1Q6. The +18-V dc off-scale voltage is applied on the altitude input signal line (J1-A) through A1R13 to the emitter of A1Q6 and the noninverting input of operational amplifier A1U1B. The off-scale input signal causes A1Q6 to conduct, which clamps the signal input to A1U1B. This clamping action prevents A1U1B from providing continuous drive to servo motor B1 when the pointer is out of view.

When level flight is attained within the indicator altitude range, the inputs to U3A and U3B are equal, causing equal inputs to be applied to servo motor B1. Servo motor B1 is nulled and does not rotate in either direction.

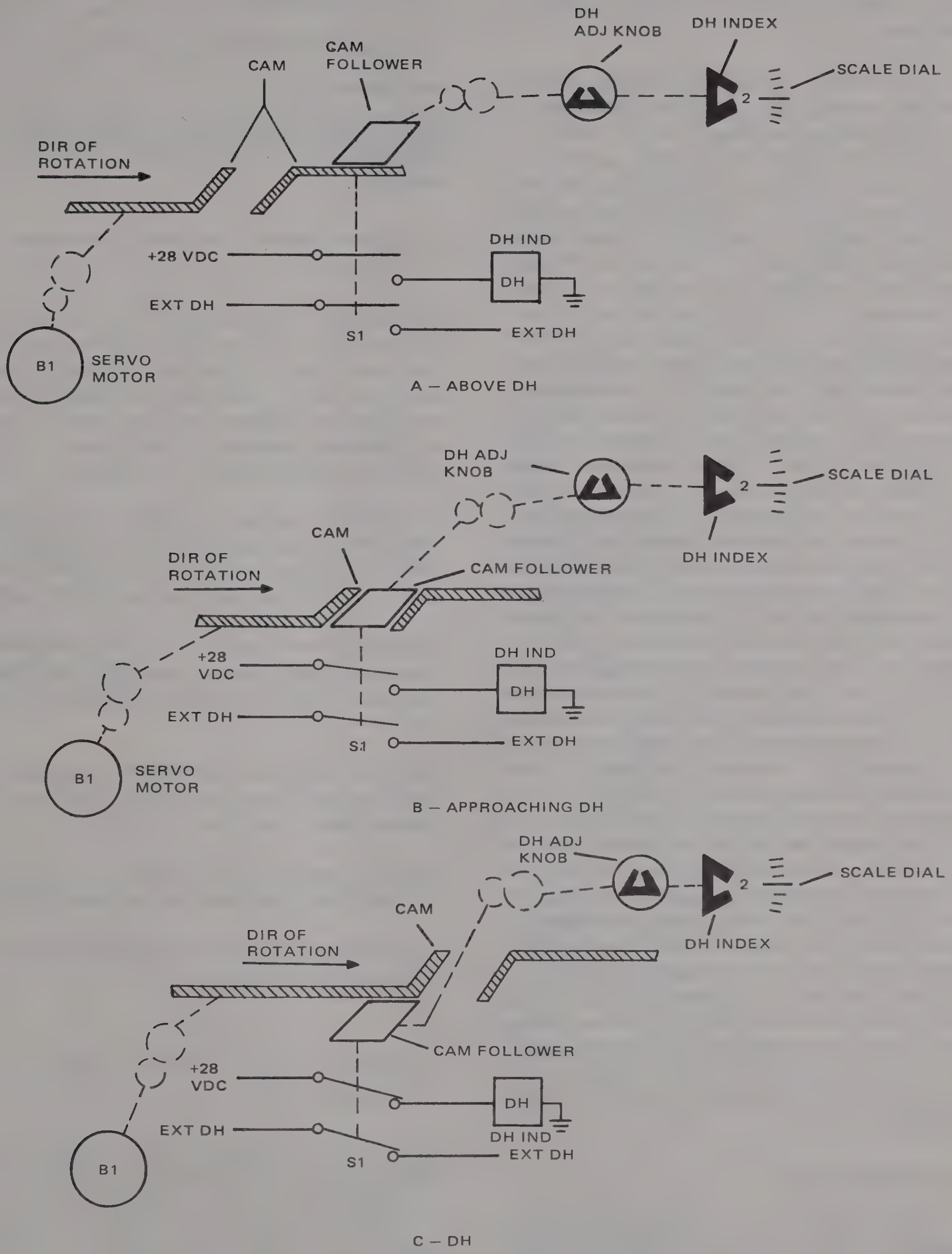
Servo motor B1 is mechanically coupled to the pointer, follow potentiometer R1, and DH switch S1.

7.2.2 Decision Height (DH) Circuit (Refer to figure 5.)

The DH knob is mechanically coupled to the DH index and to the DH cam follower that controls DH switch S1. Servo motor B1 is mechanically coupled to the cam. The DH knob is manually adjusted to set the DH index to the selected decision height and sets the cam follower to the correct position.

During aircraft descent, the cam follower rides the outer surface of the cam when the aircraft is above the decision height. Refer to figure 5, view A. When the cam follower is on the outer surface of the cam, DH switch S1 is held open. As the aircraft approaches the decision height, the cam follower drops through a slot in the cam and begins to close switch S1. Refer to figure 5, view B. At the selected decision height, the cam follower is forced to ride on the inner surface of the cam and switch S1 is closed. Refer to figure 5, view C. The +28 V dc is applied to the DH indicator and the indicator lights. The external DH voltage is applied through S1 to an external system that requires triggering at the decision height. The cam follower remains on the inner surface of the cam and S1 is held closed at all altitudes below the decision height.

During aircraft ascent, the DH indicator remains lit until the cam follower reaches the slot in the cam. The cam must rotate beyond the selected decision height before the cam follower is forced upward in the slot to open switch S1. The DH indicator remains lit until the aircraft reaches an altitude of 10 to 20 feet above the selected decision height.


DH ADJ KNOB
DH INDEX
CAM
CAM FOLLOWER
SCALE DIAL
DIR OF ROTATION
2
+28 VDC
DH IND
DH
EXT DH
S1
EXT DH
B1
SERVO MOTOR
A — ABOVE DH
DH ADJ KNOB
SCALE DIAL
2
CAM
DIR OF ROTATION
CAM FOLLOWER
DH INDEX
+28 VDC
DH IND
DH
EXT DH
S1
EXT DH
B1
SERVO MOTOR
B — APPROACHING DH
DH ADJ KNOB
SCALE DIAL
2
CAM
DIR OF ROTATION
DH INDEX
CAM FOLLOWER
+28 VDC
DH
EXT DH
DH IND
EXT DH
S1
B1
C — DH

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Decision Height (DH) Circuit Operation
Figure 5

7.2.3 Flag Circuit (Refer to figure 1 of 339H-4/4A Radio Altitude Indicator diagrams section.)

When the feedback voltage is correctly tracking the altitude voltage, the difference between the outputs of isolation amplifiers A1U1A and U1B is less than 150 millivolts. Both outputs are applied through A1R16 and R17 to flag differential amplifier A1U2B. The inputs balance U2B and a zero output is applied to diode bridge A1CR3, CR4, CR5, CR6. Resistor A1R20 and R23 and diode A1CR6 form a voltage divider, and a nominal +3.4 V dc is applied to the noninverting input of voltage comparator A1U2A. Resistor A1R20 and R22 and diode A1CR4 form a voltage divider, and a nominal -3.6 V dc is applied to the inverting input of U2A. Comparator U2A produces a plus voltage that is applied through voltage divider A1R24, R25 to transistor switch A1Q1. Diode A1CR7 removes negative transient spikes to prevent intermittent flag warnings. Transistor Q1 turns on and applies a ground to flag meter mechanism M1. The +22-V dc flag voltage is applied from J1-D to M1. Meter mechanism M1 energizes and pulls the warning flag out of view when the altitude voltage exceeds the feedback voltage by more than 150 millivolts, A1U2B applies a plus voltage to bridge A1CR3, CR4, CR5, CR6. Diode CR5 is reverse biased and CR3 is forward biased. The plus voltage from U2B is applied through R20 to the inverting input of A1U2A, causing U2A to switch and apply a minus voltage through voltage divider A1R24, R25 to A1Q1. Transistor Q1 turns off and removes the ground applied to M1. Meter mechanism M1 deenergizes and the warning flag drops into view. When the feedback voltage exceeds the altitude voltage by more than 150 millivolts, U2B applies a minus voltage to bridge CR3, CR4, CR5, CR6. Diode CR5 is forward biased and CR3 is reverse biased. The minus voltage from U2B is applied through R21 to the noninverting input of U2A causing U2A to switch and apply a minus voltage through voltage divider R24, R25 to Q1. Transistor Q1 turns off and removes the ground applied to M1. Meter mechanism M1 deenergizes and the warning flag drops into view.

7.2.4 Self-Test Circuit

When TEST switch S2 is depressed, ground is removed from the external flag ground (J1-E), ground is applied through S2 and A1CR1 to test ground (J1-P), and through A1CR2 to the noninverting input of A1U2B. Flag differential amplifier A1U2B applies a minus voltage to bridge A1CR3, CR4, CR5, CR6, and the flag comes into view (refer to paragraph 7.2.3 for flag circuit operation).

8. DIFFERENCE DATA

8.1 General

This paragraph provides the difference between the 339H-4 and the 339H-4A Radio Altitude Indicators.

8.2 339H-4 Radio Altitude Indicator (Refer to figure 1.)

The 339H-4 Radio Altitude Indicator is designed for use in conventional fixed-wing aircraft. The scale dial is calibrated from 0 to 2,000 feet with the 0- to 500-foot portion of the scale covering 180 degrees of the dial. The 500- to 2,000-foot portion of the scale is compressed in the next 81-degrees of the dial.

The 339H-4 indicators with CPN 622-1204-001, -003, -005 are equipped with 28-volt lighting and the 339H-4 indicators with CPN 622-1204-002, -004, -006, -007, -008, -010 are equipped with 5-volt lighting.

The 339H-4 indicators with CPN 622-1204-001, -002 have a flat bezel; and the -003, -004, -005, -006, -007, -008, and -010 have a raised metal trim ring on the bezel.

The -003, -004, -005, -006, and -010 have a raised bright metal trim ring; and the -007 has a raised painted metal trim ring.

The -001, -002, -005, -006, -007 have a gray bezel; and the -003, -004, -005, -006, and -010 have a black bezel.

The -010 has a black bezel with the sloping portion of the bezel painted gray.

8.3 339H-4A Radio Altitude Indicator (Refer to figure 1.)

The 339H-4A Radio Altitude Indicator is designed for use in helicopters. The scale dial is calibrated from 0 to 2,000 feet with the 0- to 100-foot portion of the scale covering 180 degrees of the dial. The 100- to 500-foot portion of the scale is compressed in the next 72.45 degrees of the dial and the 500- to 2,000-foot portion is compressed in the next 40.75 degrees of the dial.

The 339H-4A indicators with CPN 622-1205-001, -003, -005 are equipped with 28-volt lighting, and the 339H-4A indicators, with CPN 622-1205-002, -004, -006 are equipped with 5-volt lighting.

The 339H-4A indicators with CPN 622-1205-001 and -002 have a flat bezel; and the -003, -004, -005, and -006 have a raised, bright metal trim ring on the bezel.

The -001, -002, -005, and -006 have a gray bezel and the -003 and -004 have a black bezel.

Collins 339H-4/4A Radio Altitude Indicator

Rockwell
International

maintenance

Collins General Aviation Division

Printed in USA

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5th Edition, 15 January 1988

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NOTICE: This section replaces fourth edition dated 15 January 1985.

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Record of Revisions

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ON RECEIPT OF REVISIONS, INSERT REVISED PAGES IN THE MANUAL, AND ENTER DATE INSERTED AND INITIALS.

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1. GENERAL

This section contains the procedures required to maintain the 339H-4/4A Radio Altitude Indicator. Refer to figure 1.

2. PREVENTIVE MAINTENANCE

The dial window should always be cleaned with an antistatic cleaner, such as Statnol, to prevent static charges on the dial window. Statnol is available from Weston Instrument Inc., Weston Instrument Division, 614 Frelinghuysen Ave., Newark, New Jersey 07114.

3. TEST EQUIPMENT, TOOLS, AND POWER SUPPLY REQUIREMENTS

3.1 Test Equipment

The test equipment required to test and adjust the indicator is listed in table 1.

3.2 Special Test Fixture

A 1-to-1 breakout box from the rear connector of the indicator is required to apply power and obtain test results.

3.3 Tool Requirements

The tools required to repair and adjust the indicator are listed in table 1A.

3.4 Power Supply Requirements

The power supplies required to test and adjust the indicator are listed in table 2.

4. TESTING

4.1 General

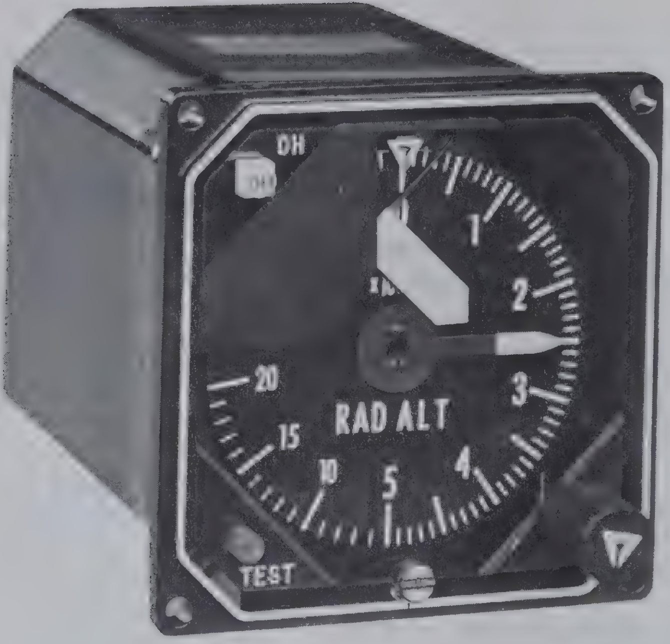
The performance test consists of individual functional tests that must be performed in sequence to accomplish a complete performance test. The functional tests enable the technician to test a functional area of the indicator when a circuit malfunction is suspected without performing the complete performance test. A complete performance test must be performed after any repair and/or adjustment is made to ensure that the indicator is in correct operating condition.

When a functional test is performed, the pretest procedure described in paragraph 4.2 must be performed before beginning the functional test.

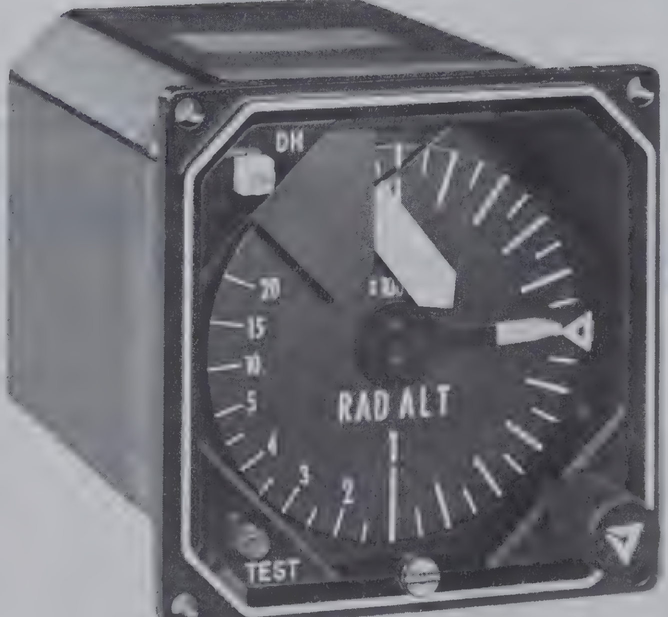
If an abnormal result is obtained during performance of the test procedures, refer to the same step of the troubleshooting procedure described in paragraph 5.

Table 1. Required Test Equipment.

TEST EQUIPMENT	PARAMETERS	SUGGESTED TYPE
Digital voltmeter	Range: 0.000 to 30.000 V dc Accuracy: ±0.02 percent Impedance: 10 megohms min dc	Fairchild, model 7000
Dc milliammeter	Range: 0 to 250 mA Accuracy: ±5 percent	Any
Continuity tester	Open: 10 megohms min Short: 0.5 ohm max Test voltage: 50 volts max	Any
Ohmmeter	Range: 0 ohms to 20 kilohms Accuracy: ±5 percent	Triplett, model 630


DH
RAD ALT
TEST
1
2
3
4
5
10
15
20

A-339H-4


DH
RAD ALT
TEST
20
15
10
5
4
3
2

B-339H-4A

TP3-6755-019

339H-4/4A Radio Altitude Indicator, Typical
Figure 1

Table 1A. Tools Required.

DESCRIPTION	CHARACTERISTIC	FUNCTION
20-watt soldering iron	Any	Used to remove/replace IC's and components
Solder sucker	Any	Used to remove solder
Needle-nose pliers	Any	Used to bend component leads
Cutting tools	Various; small diagonal cutter, end nippers, etc (sharp tools that will not leave a burr)	Used to cut IC's and component leads
Adjustment tool	JFD 5284, or equivalent	Used to adjust variable resistors
Screwdrivers	Any	Used in disassembly/ assembly
Hex wrenches	0.035 for no 2 setscrews 0.050 for no 4 setscrews	Used to loosen/tighten setscrews
Spline wrenches	0.033 for no 0 setscrews 0.048 for no 2 setscrews	Used to loosen/tighten setscrews

Table 2. Required Power Supplies.

POWER SUPPLY	PARAMETERS	SUGGESTED TYPE
0 to +22 V dc variable (+22 V dc regulated and flag)	Voltage: 0 to +22.00 V dc ±1 percent Current: 75 mA max Impedance: 1 ohm max Ac ripple: 1 percent max	Hewlett-Packard, model 6204B
-15 V dc regulated	Voltage: -15.00 ±0.15 V dc Current: 50 mA max Impedance: 1 ohm max Ac ripple: 1 percent max	Hewlett-Packard, model 6204B
0 to +30 V dc variable (servo power)	Voltage: 0 to +30 V dc ±5 percent Current: 500 mA max Impedance: 0.1 ohm max Ac ripple: 1 percent max	Electro, model EFB
0 to +20 V dc variable (altitude signal)	Voltage: 0 to +20 V dc ±1 percent Current: 10 mA max Impedance: 1 ohm max Ac ripple: 1 percent max	Hewlett-Packard, model 6204B
+28 V dc (lighting power for 622-1204-001, -003, -005 and 622-1205-001, -003, -005)	Voltage: +28.0 ±1.4 V dc Current: 200 mA max Impedance: 1 ohm max Ac ripple: 1 percent max	Electro, model EFB
+5 V dc (lighting power for 622-1204-002, -004, -006, -007, -008, -010, and 622-1205-002, -004, -006)	Voltage: +5.00 ±0.25 V dc Current: 500 mA max Impedance: 1 ohm max Ac ripple: 1 percent max	Electro, model EFB

The test procedure must be performed in a clean, dust-free area.

4.2 Pretest Procedure

a. Remove dust cover as described in disassembly paragraph 6.1.3.

Note

While performing maintenance with the covers removed from this unit, service personnel are advised to observe standard safety precautions, such as wearing safety glasses, to prevent personal injury.

b. Visually check indicator for evidence of foreign matter and check that all moving parts have clearance.
c. Connect indicator to 1-to-1 breakout box.
d. Using continuity tester, check continuity between the following points.

FROM	TO	RESULT
J1-N	J1-M	Short
J1-N	J1-S	Open
J1-N	J1-B	Open
J1-S	J1-E	Short
J1-S (-)	J1-P (+)	Open

Perform the following continuity tests with TEST switch depressed:

FROM	TO	RESULT
J1-S	J1-E	Open
J1-S (-)	J1-P (+)	Short

Note

Power supplies should be "floating" or "ungrounded" and connected to the 339H-4/4A as described in steps e through h.

e. Connect 0- to +22-V dc variable power supply at J1-H (+), J1-D (+), and J1-B(-).
f. Connect -15-V dc power supply at J1-J (-) and J1-B (+).

g. Connect 0- to +28-V dc power supply at J1-T (+), J1-U (+), J1-V (+), and J1-S (-).
h. Connect 0- to +20-V dc variable power supply (altitude signal) at J1-A (+) and J1-B (-).
i. Turn on all power supplies.
j. Adjust 0- to +22-V dc power supply to +22.000 ±0.020 V dc.
k. Adjust 0- to +28-V dc power supply to +27.5 V dc.
l. Adjust altitude signal power supply to 0.000 Vdc at J1-A and J1-B.

4.3 Current Test

a. Turn off all power supplies.
b. Connect dc milliammeter in series with + lead connected to J1-H.
c. Turn on all power supplies.
d. Read dc milliammeter. On 339H-4, current limit is 55 mA maximum. On 339H-4A, current limit is 65 mA maximum.
e. Turn off all power supplies.
f. Disconnect milliammeter from J1-H lead and connect in series with - lead from -15-V dc power supply to J1-J.
g. Turn on all power supplies.
h. Read dc milliammeter. Current must be 3 mA minimum to 15 mA maximum.
i. Turn off all power supplies.
j. Disconnect milliammeter from J1-J and connect in series with + lead from +27.5-V dc power supply to J1-T.
k. Turn on all power supplies.
l. Read dc milliammeter. Current limit is 150 mA maximum.
m. Vary altitude signal between +5 and +15 V dc while observing dc milliammeter. Current must not exceed 200 mA while servo motor is running.
n. Adjust altitude signal power to 0.000 V dc at J1-A and J1-B.
o. Turn off all power supplies.
p. Disconnect milliammeter from J1-T.
q. Turn on all power supplies.
r. Connect dvm at J1-A (+) and J1-B (-).

4.4 Warning Flag Test

a. Observe warning flag on indicator. Flag must be completely out of view.
b. Decrease 0- to +22-V dc variable power supply to +4.0 V dc.
c. Observe warning flag. Flag must be in view. Adjust variable power supply to +22 V dc.
d. Adjust altitude signal at J1-A and J1-B to +10.000 V dc and wait for servo motor to stabilize.
e. Block servo motor to prevent servo loop operation.
f. Increase altitude signal at J1-A and J1-B until warning flag just comes in view.
g. Read dvm. Voltage must not exceed +10.30 V dc.
h. Decrease altitude signal at J1-A and J1-B to +10.000 V dc and wait until flag goes out of view.
i. Decrease altitude signal at J1-A and J1-B until flag just comes in view.
j. Read dvm. Voltage must exceed +9.70 V dc.
k. Increase altitude signal at J1-A and J1-B to +10.000 V dc and wait for flag to go out of view.
l. Unblock servo motor.
m. Decrease altitude signal at J1-A and J1-B to 0.000 V dc.

4.5 Altitude Indication Test

a. Adjust altitude signal at J1-A and J1-B to center pointer on altitudes indicated in table 3 for 339H-4 or table 4 for 339H-4A and read dvm indication. Tap the indicator lightly at each altitude indication to reduce the effects of friction. Perform altitudes in sequence listed in table. Dvm indication must be within tolerances shown.
b. Adjust altitude signal at J1-A and J1-B to +18.000 V dc and observe pointer. Pointer must be completely hidden under mask.

Note

Step c applies to 339H-4 units with SB 5, 339H-4A units with SB 6, and to 339H-4 units with circuit board A1 CPN 618-3690-001 marked REV K or greater, and 339H-4A units with circuit board A1 CPN 618-3690-002 marked REV L or greater.

c. Adjust altitude signal at J1-A and J1-B to +20.0 ±0.1 V dc and observe servo motor and clutch. The servo motor should not rotate and cause the clutch to slip.
d. Adjust altitude signal at J1-A and J1-B to 0.000 V dc.

4.6 Decision Height Test

a. Adjust altitude signal at J1-A and J1-B to +15.000 V dc.

Table 3. 339H-4 Altitude Analog Voltages.

ALTITUDE (ft)	DVM INDICATION (Vdc)	
	RANGE	NOMINAL
-20	-0.060 to +0.060	0.000
0	+0.340 to +0.460	+0.400
50	+1.340 to +1.460	+1.400
100	+2.340 to +2.460	+2.400
300	+6.280 to +6.520	+6.400
500	+10.200 to +10.435	+10.400
1,000	+11.795 to +12.005	+11.900
2,000	+14.690 to +15.110	+14.900
1,500	+13.242 to +13.558	+13.400
1,000	+11.795 to +12.005	+11.900
700	+10.927 to 11.073	+11.000
500	+10.200 to +10.435	+10.400
400	+8.240 to +8.560	+8.400
300	+6.280 to +6.520	+6.400
250	+5.300 to +5.500	+5.400
200	+4.320 to +4.480	+4.400
150	+3.340 to +3.460	+3.400
100	+2.340 to +2.460	+2.400
50	+1.340 to +1.460	+1.400

Table 4. 339H-4A Altitude Analog Voltages.

ALTITUDE (ft)	DVM INDICATION (V dc)	
	RANGE	NOMINAL
0	+0.340 to +0.460	+0.400
50	+1.340 to +1.460	+1.400
100	+2.340 to +2.460	+2.400
300	+6.190 to +6.610	+6.400
500	+9.980 to +10.463	+10.400
1,000	+11.750 to +12.050	+11.900
2,000	+14.600 to +15.200	+14.900
1,500	+13.175 to +13.625	+13.400
1,000	+11.750 to +12.050	+11.900
500	+9.980 to +10.463	+10.400
400	+8.120 to +8.680	+8.400
300	+6.190 to +6.610	+6.400
200	+4.260 to +4.540	+4.400
100	+2.340 to +2.460	+2.400
90	+2.140 to +2.260	+2.200
80	+1.940 to +2.060	+2.000
70	+1.740 to +1.860	+1.800
60	+1.540 to +1.660	+1.600
50	+1.340 to +1.460	+1.400
40	+1.140 to +1.260	+1.200
30	+0.940 to +1.060	+1.000
20	+0.740 to +0.860	+0.800
10	+0.540 to +0.660	+0.600

b. Adjust DH knob to center DH index on altitude specified in table 5 and slowly decrease altitude signal at J1-A and J1-B until DH indicator just lights.

c. Read dvm and compare with dvm indication listed in table 5. Voltage must be within tolerance shown in table.

d. Slowly increase altitude signal at J1-A and J1-B until DH indicator just goes out.

e. Read dvm and compare with dvm indication in table 5 for increasing altitude. Voltage must be within tolerance shown in table.

f. Proceed to next altitude listed in table 5 and repeat steps b through f until all altitudes are checked.

g. Increase altitude signal at J1-A and J1-B until DH indicator goes out.

h. Measure voltage at J1-R (+) and J1-S (-). Voltage should be 0 V dc nominal.

i. Decrease altitude signal at J1-A and J1-B until DH indicator just lights.

j. Measure voltage at J1-R (+) and J1-S (-). Voltage should be +27.5 V dc nominal.

4.7 Self-Test Test

a. Depress TEST switch and observe warning flag. Flag must come in view. Release TEST switch.

b. Connect dvm at J1-D (+) and J1-E (-).

c. Depress TEST switch and read dvm. Voltage should be 0 V dc nominal. Release TEST switch.

d. Disconnect dvm from J1-D and J1-E.

4.8 Lighting Test

Note

Shade indicator dial or perform test procedure in a dark area so that the indicator dial lighting can be seen.

a. On 339H-4 indicators with CPN 622-1204-001, -003, -005 and 339H-4A indicators with CPN 622-1205-001, -003, -005, connect +28-V dc power supply to J1-L (+) and J1-M (-); or, on 339H-4 indicators with CPN 622-1204-002, -004, -006, -007, -008, -010, and

Table 5. Decision Height Voltage Chart.

CENTER DH INDEX ON (ft)	DVM INDICATION WHEN DH IND LIGHTS - DECREASING ALTITUDE (V dc)		DVM INDICATION WHEN DH IND GOES OUT - INCREASING ALTITUDE (V dc)	
	339H-4	339H-4A	339H-4	339H-4A
1,500	+13.220 to +13.580	+12.950 to +13.850	+13.610 to +13.970	+13.970 to +14.870
1,000	+11.720 to +12.080	+11.450 to +12.350	+12.110 to +12.470	+12.470 to +13.370
400	+8.200 to +8.600	+8.100 to +8.700	+8.600 to +9.000	+8.800 to +9.400
300	+6.200 to +6.600	+6.100 to +6.700	+6.600 to +7.000	+6.800 to +7.400
200	+4.200 to +4.600	+4.100 to +4.700	+4.600 to +5.000	+4.800 to +5.400
100	+2.200 to +2.600	+2.340 to +2.460	+2.600 to +3.000	+2.800 to +3.400
80	+1.800 to +2.200	+1.940 to +2.060	+2.200 to +2.600	+2.040 to +2.160
50	+1.200 to +1.600	+1.340 to +1.460	+1.600 to +2.000	+1.440 to +1.560
30	+0.800 to +1.200	+0.940 to +1.060	+1.200 to +1.600	+1.040 to +1.160
0	+0.200 to +0.600	+0.340 to +0.460	+0.600 to +1.000	+0.440 to +0.560

339H-4A indicators with CPN 622-1205-002, -004, -006, connect +5.0-V dc power supply to J1-C (+) and J1-M (-).

b. Observe indicator dial lighting. Lighting must be uniform over entire dial.
c. Disconnect power supply.

4.9 Posttest Procedure

a. Turn off all power supplies.
b. Disconnect indicator from breakout box.
c. Install dust cover as described in assembly paragraph 6.2.35.

5. TROUBLESHOOTING

5.1 General

The troubleshooting procedures are numbered the same as the performance test procedures. The same step numbering provides compatibility between the test and troubleshooting procedures and provides a quick reference between the procedures when a malfunction occurs. Step numbers are omitted when troubleshooting is not applicable to the test procedure step. The troubleshooting procedures provide required procedure for isolating a malfunction.

After the malfunction is repaired, a complete performance test must be performed to ensure correct operation of the indicator.

Refer to figure 1 in the 339H-4/4A Radio Altitude Indicator diagrams section for the schematic diagram of the indicator. The schematic diagram provides test voltage for a given altitude and decision height setting. Refer to figure 1 in the 339H-4/4A Radio Altitude Indicator illustrated parts breakdown section for component locations.

5.2 Pretest Procedure Troubleshooting

b. Remove foreign matter and clean indicator, or, if moving parts are binding, disassemble indicator and replace defective part and/or adjust clearance between moving parts.
d. Refer to schematic diagram and check wiring from rear connector J1.

5.3 Current Test Troubleshooting

c, g, j, k. Immediately turn off all power supplies and check indicator circuits for shorts, opens, and/or defective components.

5.4 Warning Flag Test Troubleshooting

a. Check flag circuit A1U2B, CR3, CR4, CR5, CR6, U2A, Q1 and flag instrument mechanism M1 circuit.
c. Check flag circuit A1U2B, U2A, Q1 and flag instrument mechanism M1.
g. Check differential amplifier A1U2B circuit.
j. Check differential amplifier A1U2B circuit.

5.5 Altitude Indication Test Troubleshooting

a. Altitude indication is not within tolerance.
    1. Perform altitude adjustment procedure described in paragraph 8.2 for 339H-4 or 8.3 for 339H-4A.
    2. Check isolation amplifier A1U1A; U1B circuit; servo A2U3A; U3BQ2, Q3, Q4, Q5 circuit; and servo motor B1.

b. Perform step 5.5 a.

5.6 Decision Height Test Troubleshooting

c, e. Perform decision height adjustment procedure as described in paragraph 8.1.
h, j. Check DH switch S1.

5.7 Self-Test Test Troubleshooting

a, c. Check TEST switch S2 circuit.

5.8 Lighting Test Troubleshooting

b. Check light DS2 circuit.

6. DISASSEMBLY/ASSEMBLY

6.1 Disassembly

6.1.1 General

The disassembly procedure sequence is from the highest assembly to the lowest subassembly, part, or component. The indicator should not be disassembled any further than necessary to make repairs. All item numbers shown in parentheses refer to figure 1 in the 339H-4/4A Radio Altitude Indicator parts list section unless otherwise specified.

6.1.2 Precautions and General Techniques

a. Perform disassembly of the indicator in a clean, dust-free area.
b. Mark, or otherwise identify, all disconnected wires. Make note of color coding, placement of leads, and methods of applying insulation before unsoldering or removing electrical components.
c. Ensure that power is removed from indicator before starting disassembly procedures to prevent voltage transients from damaging the indicator.
d. Loosen staking compound with staking compound thinner, such as General Electric Co., Glyptal thinner no 1505 (CPN 005-0164-000).
e. Loosen screws that were installed with retaining compound by applying heat to screwheads. Do not use this method on screws that attach display parts, but apply pressure downward on screwhead during removal until retaining compound loosens.

6.1.3 Removal of Dust Cover

a. Remove tape (2) that seals seam between bezel (67) and dust cover (3).
b. Loosen two captive fasteners (4) on rear of indicator and slide off dust cover.

6.1.4 Removal of Connector Plate and Connector J1

a. Remove four screws (25) that secure connector plate (21) to four posts (26).
b. Separate connector plate from indicator.

Note

Perform steps c and d only if connector J1 (18) or connector plate (24) is being replaced.

c. Tag and unsolder wires connected to connector J1 (18).
d. Remove four self-locking nuts (19) and screws (20) and remove connector J1 and connector plate.

6.1.5 Removal of Terminal Board A1

a. Remove four screws (13) and separate terminal board A1 (11) from indicator.
b. Tag and unsolder wires connected to A1.

6.1.6 Removal of Terminal Board A2

a. Remove four screws (13) and separate terminal board A2 (12) from indicator.
b. Tag and unsolder wires connected to A2.

6.1.7 Removal of DH Knob

a. Loosen two setscrews (58) and remove DH knob (59).
b. Remove two setscrews (58).

6.1.8 Removal of Light Assembly

a. Remove two screws (63) and remove access cover (62).
b. Lift light assembly DS2 (64) from indicator.
c. Tag and unsolder wires connected to light assembly.
d. Refer to repair paragraph for replacement of lamps.

6.1.9 Removal of DH Indicator

a. Remove three screws (53) and lockwashers (54).
b. Loosen one screw (56) located partially under TEST switch S2 (151).
c. Carefully remove light assembly wires from bezel (67).
d. Separate bezel from indicator.
e. Pull DH indicator lens (P/O 60) off of DH lamp assembly (60).
f. Remove lamp (61).
g. Tag and unsolder wires connected to DH lamp assembly.
h. From rear of bezel, push out DH indicator lamp assembly.

6.1.10 Removal of Bezel

a. Remove TEST switch S2 extension (149) and gasket (150).
b. Place bezel (67) in protective container to prevent damage to lighting wedge (68).

6.1.11 Removal of Flag Meter Mechanism M1

a. Tag and unsolder flag meter mechanism M1 (32) lead wires.
b. Remove nut (33) and screw (34).
c. Carefully push M1 out of bracket (29).
d. Place M1 in a protective container to prevent damage to flag and meter mechanism.

6.1.12 Removal of Display Mask

a. Remove two screws (77) and spacers (78), and one spacer (79).
b. Remove display mask (76).

6.1.13 Removal of Altitude Pointer and Dial

a. Remove two screws (81).
b. Carefully remove pointer (80).
c. Remove altitude dial (82) from cam disc hub (87).
d. Remove bushing (83).

6.1.14 Removal of Background Mask

a. Remove three screws (85).
b. Remove background mask (84).

6.1.15 Removal of Cam Disc and Cam Follower

a. Loosen two setscrews (88) and remove cam disc assembly (86).
b. Remove two setscrews (88).
c. Remove two screws (91) and cam follower assembly (90).
d. Remove washer (96).

6.1.16 Removal of Switch Actuator Spring

a. Remove screw (99) and post (98).
b. Remove two screws (99) and switch actuator spring (97).

6.1.17 Removal of Bearing Plate Posts

a. Holding four screws (121) stationary, unthread and remove four bearing plate posts (120).
b. Remove four screws (121) and lockwashers (122).

6.1.18 Removal of Output Gear

a. Loosen two setscrews (38) and remove output gear assembly (37).
b. Remove two setscrews (38).
c. Remove two screws (40) and stops (39).
d. Remove output gear (41).

6.1.19 Removal of DH Knob Gearshaft

a. Remove nut (141), flat washer (142), tension washer (143), and flat washer (142).
b. Remove DH gearshaft (137), bushing (145), and special washer (144).

6.1.20 Removal of 13-Tooth Idler Gear and Post

a. Remove retaining ring (117) and 13-tooth idler gear (116).
b. Remove two retaining rings (117,119) and idler gear post (118).

6.1.21 Removal of Potentiometer R1

a. Tag and unsolder potentiometer R1 (102) leads.
b. Remove two screws (103), lockwashers (104), and rim-clenching washers (105).
c. Remove potentiometer R1.

6.1.22 Removal of 130-Tooth DH Gear and Bearing Mounting Plate

a. Remove four nuts (107), lockwashers (108), and flat washers (109).
b. Carefully pull bearing mounting plate (123) away from motor mounting plate (153).
c. Remove three ball bearing (125, 127, 136) and one tension washer (135) from under bearing (136).
d. Remove two screws (110) and posts (111).
e. Remove retainer plate (106) and 130-tooth DH gear assembly.
f. Remove four screws (101) and two stop plates (100). On 339H-4A indicators, remove two screws (101) and one stop plate (100).
g. Remove two screws (114), one DH index (113), and one bracket guide (112).
h. Remove DH gear (115) and bearing mounting plate (123).

6.1.23 Removal of Servo Motor B1

a. Tag and unsolder servo motor B1 (146) leads.
b. Remove two screws (147) and lockwashers (148), and remove servo motor B1.

6.1.24 Removal of DH Switch S1

a. Tag and unsolder wires connected to DH switch S1 (35).
b. Remove two screws (36) and switch S1.

6.1.25 Removal of Gear Train

a. Remove second reduction gearshaft (124) and bearing (125).
b. Remove first reduction gearshaft (126) and bearing (127).
c. Remove clutch assembly (128 through 135).
d. Disassemble clutch assembly.
   1. Remove retaining ring (135).
   2. Loosen two setscrews (130) and remove collar (129).
   3. Remove clutch gear (131), tension washer (133), retaining ring (132), bearing (134), and gearshaft (128).

6.1.26 Removal of TEST Switch S2

a. Tag and unsolder wires connected to TEST switch S2 (151).
b. Remove bushing (152), key washer (P/O 151), and switch S2.
c. Remove screw (56).

6.1.27 Removal of DH Stop Gear and Shaft

a. Remove retaining ring (46) and stop gear assembly (42).
b. Remove two screws (44) and stops (43).
c. Remove stop gear (45).
d. Remove screw (49), lockwasher (50), flat washer (51), and shaft (47).
e. Remove retaining ring (46) and spacer (48).

6.2 Assembly

6.2.1 General

The assembly procedures are presented in the order of assembly from the lowest part, component, or subassembly to the highest assembly. This paragraph provides the techniques, notes, and cautions required during assembly. All item numbers shown in parentheses refer to figure 1 in the 339H-4/4A Radio Altitude Indicator parts list section unless otherwise specified.

6.2.2 Precautions and General Techniques

Caution

When replacing a solid-state device, use a heat sink on the leads.

a. Reconnect all wiring after installing each component or part. Before soldering any part or lead, refer to notes of color coding, placement of leads, and insulation that were made during disassembly.
b. All soldering must be performed in accordance with MIL-S-6872 using rosin-core solder, Federal Specification QQ-S-5716, composition Sn 60.
c. Replace any defective wiring with wire of the same size and color coding.
d. Lace all wiring harnesses and tie at all breakout points. Laces should be 1/2 inch apart. Use dacron lacing cord, approved nonwaxed lacing cord, or Tyraps.
e. Liquid stake all specified screws with staking compound, such as General Electric Co., Glyptal (CPN 005-0133-010).
f. Install all retaining rings and washers with burr side away from the bearing surfaces.
g. Lubrication substitutes are not recommended because of possible incompatibility and/or contamination.
h. Retaining compound used in the assembly procedures is a sealant, such as Loctite Corp., Loctite Sealant, grade D (CPN 005-0552-000) or equivalent.
i. Silicone grease used for lubricating the gear train is General Electric Co., Versilube G300 (CPN 005-0564-000).

6.2.3 Installation of DH Stop Gear and Shaft

a. Install retaining ring (46) and spacer (48) on shaft (47).
b. Install shaft (47) in motor mounting plate (153) and secure with flat washer (51), lockwasher (50), and screw (49). Tighten screw just enough to compress lockwasher (50).
c. Apply staking compound to screw (49).
d. Install two stops (43) on DH stop gear (45) and start two screws (44).
e. Apply retaining compound to threads of two screws (44) and tighten screws.
f. Apply a thin film of silicone grease to shaft (48).
g. Install DH stop gear assembly (42) on shaft (48) and secure with retaining ring (46).

6.2.4 Installation of TEST Switch S2

a. Install screw (56) in motor plate (153) adjacent to location of TEST switch S2 (151).

Note

Perform step b only when a new TEST switch S2 is installed.

b. Remove and discard nut and internal shake washer from new TEST switch S2.
c. Install TEST switch S2 (151) in motor mounting plate (153) and secure with key washer (P/O 151) and bushing (152). Refer to figure 2.

6.2.5 *Installation of DH Switch S1*

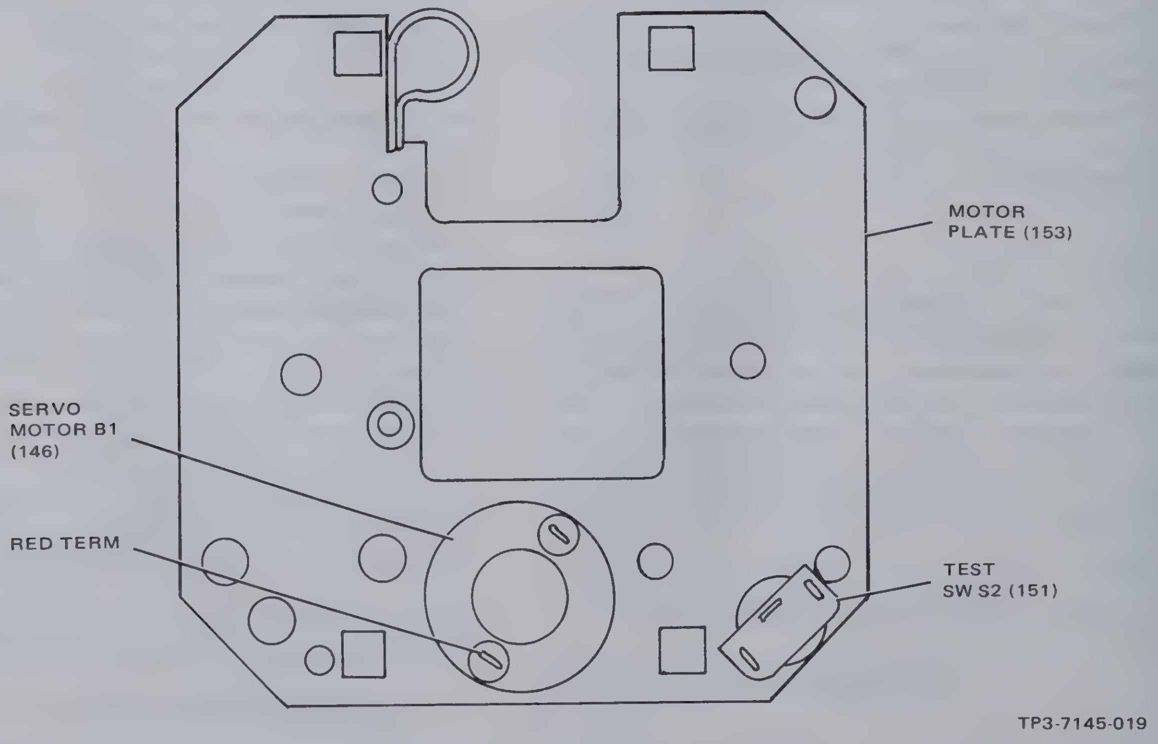
Install DH switch S1 (35) on motor mounting plate (153) and secure with two screws (36).

6.2.6 *Installation of Servo Motor B1*

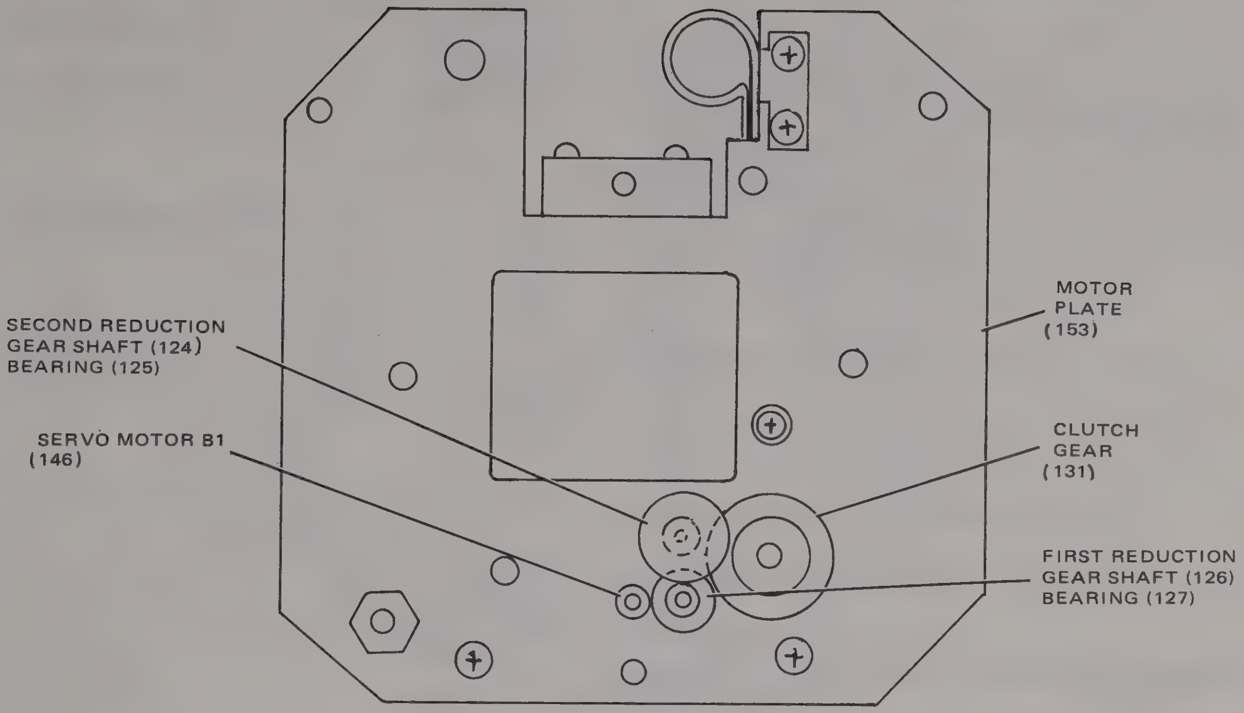
a. Position servo motor B1 (146) on rear of motor mounting plate (153) as shown on figure 2.
b. Install two lockwashers (148) and screws (147).

6.2.7 *Installation of Gear Train*

a. Assemble clutch assembly.
   1. Install bearing (134) on gearshaft (128) and secure with retaining ring (133).
   2. Start two setscrews (130) in collar (129).
   3. Install tension washer (133) on gearshaft (128) with dished side away from bearing.
   4. Install gear (131) and collar (129) on gearshaft. Position gear against washer so that 0.4 ±0.1 ounce-inch of torque is required to turn gear. Apply retaining compound to threads of two setscrews (130) and tighten setscrews.
   5. Install retaining ring (135).
b. Install clutch assembly in motor mounting plate (153).
c. Install bearing (127) in motor mounting plate.
d. Install first reduction gearshaft (126) with large gear toward motor mounting plate. Mesh large gear with servo motor B1 gear. Refer to figure 3.



Servo Motor B1 Position
Figure 2


SECOND REDUCTION GEAR SHAFT (124) BEARING (125)
SERVO MOTOR B1 (146)
MOTOR PLATE (153)
CLUTCH GEAR (131)
FIRST REDUCTION GEAR SHAFT (126) BEARING (127)
TP3-7146-019

Gear Train Installation
Figure 3

e. Install bearing (125) in motor mounting plate.
f. Install second reduction gearshaft (124) with small gear toward motor mounting plate. Mesh large gear with small gear on first reduction gearshaft and mesh small gear with clutch gearshaft.

6.2.8 Installation of Bearing Mounting Plate

a. Install two bearings (125, 127) in bearing mounting plate (123).
b. Install tension washer (135) and bearing (136) in bearing mounting plate. Tension washer is installed between mounting plate and bearing shoulder.
c. Install two posts (111) on motor mounting plate (153) with short shoulder installed in motor mounting plate.
d. Carefully position bearing mounting plate (123) on four posts (111). Ensure that gearshafts properly seat in bearings.

6.2.9 Installation of 130-Tooth DH Gear

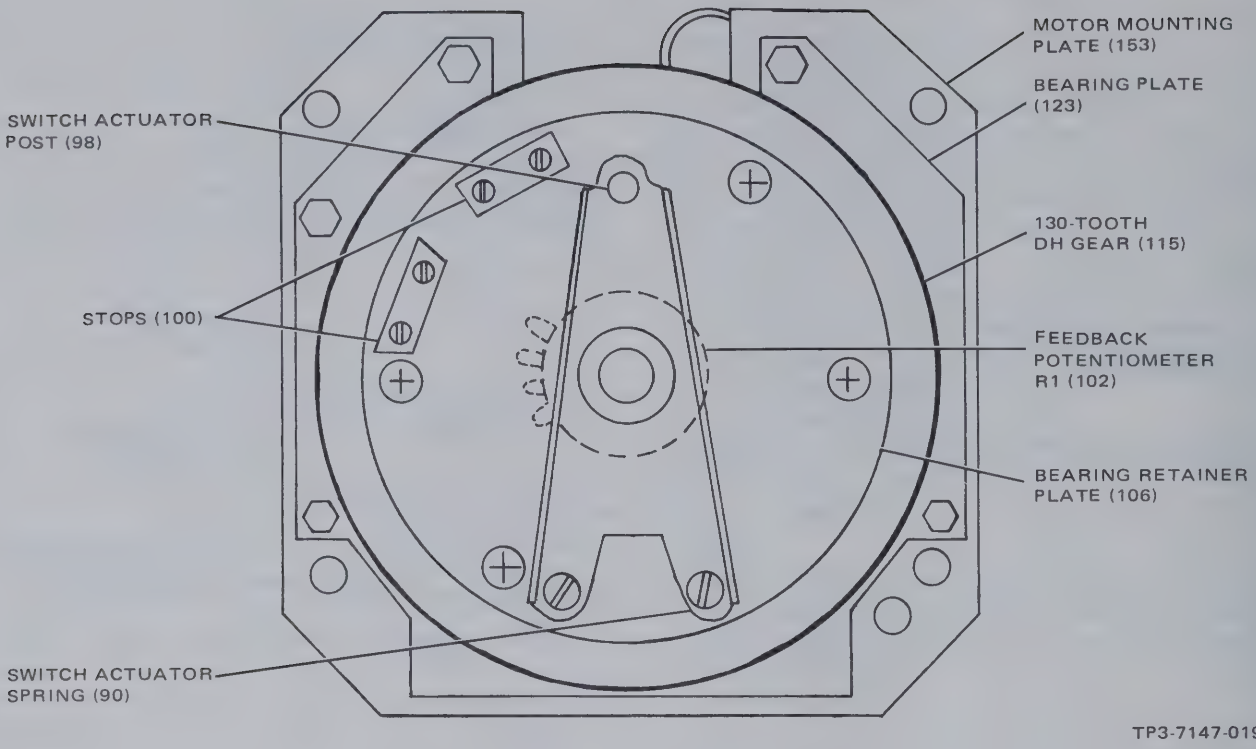
a. Position 130-tooth DH gear (115) on bearing mounting plate (123).
b. Install bearing retainer plate (106) on mounting plate (123) and secure with four screws (110), flat washers (109), lockwashers (108), and nuts (107).

6.2.10 Installation of Feedback Potentiometer R1

a. Position feedback potentiometer R1 (102) on bearing retainer plate (106) as shown in figure 4.
b. Install two rim-clenching washers (105), lockwashers (104), and screws (103).

6.2.11 Installation of 13-Tooth Idler Gear

a. Install shaft (118) in bearing mounting plate (123) and secure with two retaining rings (117, 119).
b. Install 13-tooth idler gear (116) and mesh with 130-tooth DH gear (115).
c. Install retaining ring (117).


MOTOR MOUNTING PLATE (153)
BEARING PLATE (123)
SWITCH ACTUATOR POST (98)
130-TOOTH DH GEAR (115)
STOPS (100)
FEEDBACK POTENTIOMETER R1 (102)
BEARING RETAINER PLATE (106)
SWITCH ACTUATOR SPRING (90)
TP3-7147-019

Switch Actuator and 130-Tooth DH Gear Installation
Figure 4

6.2.12 Installation of Stop Plates

Note

On 339H-4 indicators perform step a or on 339H-4A indicators perform step b.

a. Install two stop plates (100) and secure with four screws (101). Refer to figure 4.
b. Install stop plate (100) and secure with two screws (101).

6.2.13 Installation of DH Switch Actuator Spring and Post

a. Install switch actuator spring (97) over shaft of R1 (102) and secure with two screws (99).
b. Apply staking compound to two screws (99).
c. Install switch actuator post (98) from rear of bearing mounting plate (123) and secure with screw (99).

6.2.14 Installation of Cam Follower

a. Install special washer (96) on shaft of R1 (102).
b. Install cam follower assembly (90) and loosely install two screws (91).

6.2.15 Installation of DH Index

a. Align DH bracket mounting holes on DH gear (115) with slot in cam follower.
b. Install bracket (112) and DH index (113) and secure with two screws (114). Tab on bracket fits in cam follower slot.
c. Apply staking compound to two screws (114).
d. Adjust cam follower (90) to move freely along tab of bracket (112). Ensure that cam follower does not contact shaft of R1 throughout cam follower travel. Tighten two screws (91).

6.2.16 Installation of Cam Disc

a. Start two setscrews (88) in hub (87) of cam disc (86).

b. Install cam disc (86) on shaft of R1 (102).
c. Axially adjust cam disc to actuate DH switch S1 (35) and lightly tighten two setscrews (88). Adjustment is not critical at this time but is required to position cam disc for further assembly of indicator.

6.2.17 Installation of Output Gear

a. Install two posts (39) on output gear (41) and secure with two screws (40). Apply retaining compound to two screws (40).
b. Loosely install two setscrews (38).
c. Install output gear (37) on rear shaft of R1 (102) and mesh with small DH stop gear (42).
d. Position output gear stops (39) as shown in figure 5 and tighten two setscrews (38).
e. Rotate output gear from stop to stop and check that stops (43) on DH gear (42) and stops (39) on output gear (37) contact each other squarely and the gear rotation is 336 ±5 degrees.

6.2.18 Installation of Pinned Gearshaft

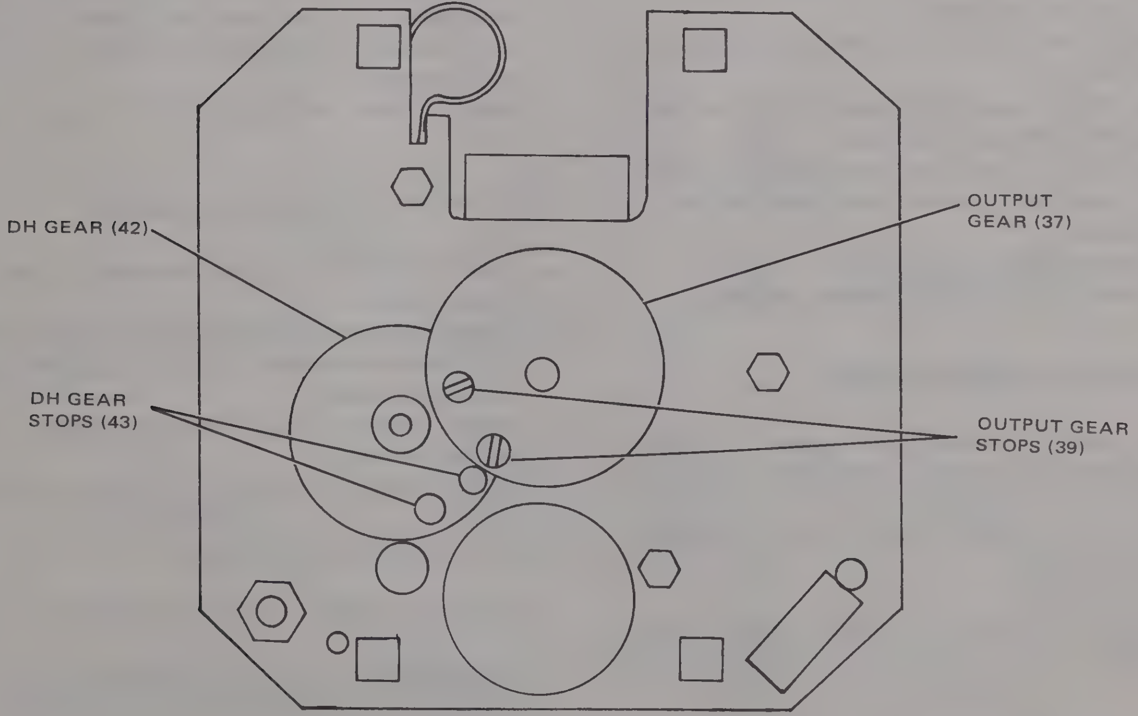
a. Install bushing (145) and special washer (144) on pinned gearshaft (137).
b. Install gear shaft in motor mounting plate (153) and secure with flat washer (142), tension washer (143), flat washer (142), and self-locking nut (141). Mesh gearshaft gear with 13-tooth idler gear. Tighten nut until 0.010-inch clearance is provided between two flat washers (142).

6.2.19 Installation of Bearing Plate Posts

Install four posts (120) and secure with four lockwashers (122) and screws (121).

6.2.20 Installation of Background Mask

a. Position background mask (84) on four posts (120).
b. Install four screws (85).
c. Apply staking compound to three screws (85).



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Output Gear Installation
Figure 5

6.2.21 Installation of Altitude Dial and Pointer

a. Install bushing (83) in altitude dial (82) with thick section toward front of indicator.
b. Install dial on shaft of R1 (102) and align screw hole with upper left screw hole in background mask (84).
c. Install altitude pointer (80) on collar (87) and secure with two screws (81).

6.2.22 Installation of Display Mask

a. Install two spacers (78), one spacer (79), and display mask (76), and secure with two screws (77).
b. Apply staking compound to two screws (77).

6.2.23 Decision Height Adjustment

Perform decision height adjustment as described in paragraph 8.1.

6.2.24 Installation of Flag Meter Mechanism M1

a. Install bracket (29) on motor mounting plate (153) and secure with two lockwashers (27, 31) and screws (28, 30).
b. Carefully install flag meter mechanism M1 (32) in bracket.
c. Adjust M1 to clear DH index (113) and altitude pointer (80) by 0.015 inch.
d. Adjust M1 so that flag is completely hidden under mask (76) when the arm of M1 is fully raised.
e. Install screw (34) and nut (33).
f. Apply staking compound to screw and nut.

6.2.25 Installation of DH Indicator

a. From front of bezel (67), press DH lamp assembly (60) in bezel and align terminals horizontally.
b. Connect and solder wires to lamp assembly and remove tags.
c. Install lamp (61).
d. Press DH indicator lens (P/O 60) on lamp assembly.

6.2.26 Installation of Bezel

a. Using clean, soft cloth, clean both sides of dial window (68).
b. Using clean, soft cloth, apply antistatic cleaner, such as Statnol, to both sides of dial window.
c. Using damp, clean cotton, uniformly spread antistatic cleaner over both sides of dial window.
d. Allow cleaner to dry to a light haze.
e. Using clean, soft cloth, polish both sides of dial window until haze is just barely visible and no streaks appear.

Note

Use care not to touch dial window during remainder of assembly procedures.

f. Install light assembly wire through hole in top of bezel. Do not scrape wire on sharp edges of bezel.
g. Install three posts (53) and one post (52).
h. Install gasket (150) on TEST switch extension shaft (149).
i. Install extension shaft on TEST switch S1 (151).
j. Install bezel assembly on indicator and tighten screw (56) located near TEST switch S1. Spread posts on bezel slightly during installation to maintain a 0.008- to 0.010-inch clearance between DH knob gear (139) and post (53).
k. Install three lockwashers (54) and screws (53).

6.2.27 Installation of Light Assembly

a. Solder wires to light assembly (64) and remove tags.
b. **Install light assembly DS2 and cover, as required, with 2-inch-wide tape (CPN 014-1353-050) to prevent light leaks.**
c. Install access cover (62) and secure with two screws (63).
d. Apply staking compound to two screws (63).

6.2.28 Installation of DH Knob

a. Press DH shaft bushing in front of bezel (67).
b. Start two setscrews (58) in DH knob (57).
c. Install DH knob and tighten two setscrews.

6.2.29 Altitude Adjustment

a. Solder wires to terminal board A1 (11) and A2 (12). Remove tags.

b. Check that all wires to be connected to connector J1 (18) have insulation sleeving on wire ends. If sleeving is missing, install 1/4 inch of sleeving over end of wire.
c. Solder wires to J1 and remove tags.
d. Slide insulation sleeving over solder pots on J1.
e. Position A1, A2, and J1 to prevent shorting out of components and/or bias voltages.
f. Perform altitude adjustment as described in paragraph 8.2 for 339H-4 or paragraph 8.3 for 339H-4A.

6.2.30 Installation of Terminal Board Posts

Install four terminal board posts (26) and secure with four lockwashers (28) and screws (27).

6.2.31 Installation of Terminal Board A1

a. Install A1 and secure with four screws (13).
b. Apply staking compound to four screws.

6.2.32 Installation of Terminal Board A2

a. Install A2 and secure with four screws (13).
b. Apply staking compound to four screws.

6.2.33 Installation of Connector J1 and Connector Plate

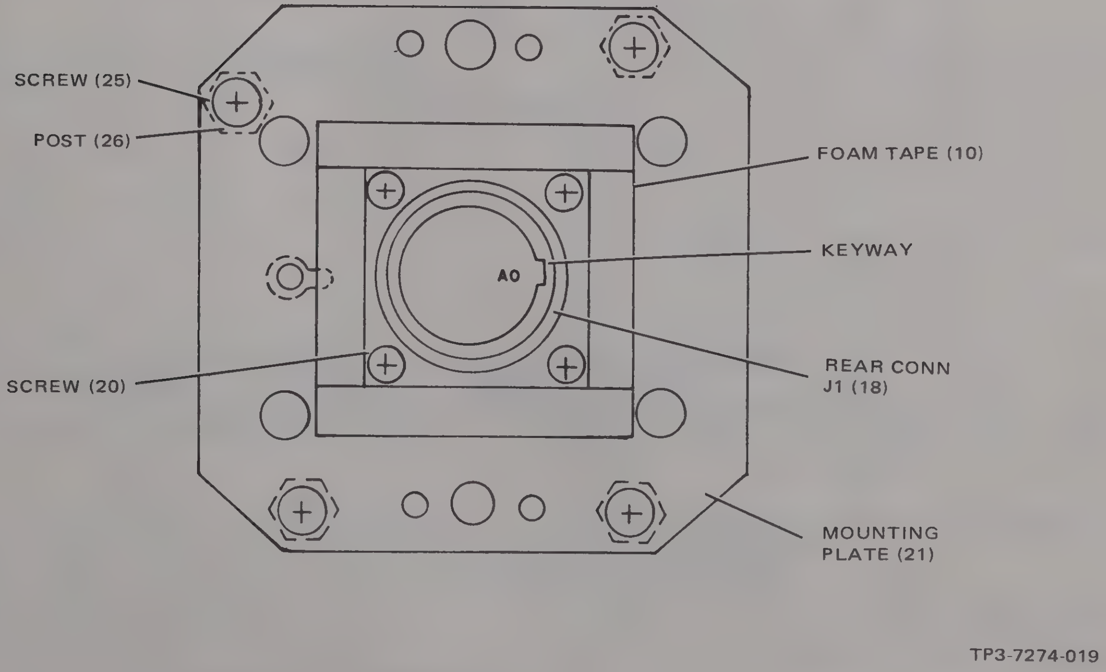
a. Install connector J1 in connector plate (24) and secure with four screws (20) and self-locking nuts (19). Refer to figure 6 for connector position in connector plate.
b. Install connector plate on indicator and secure with four screws (20).
c. Apply staking compound to four screws (20).

6.2.34 Lubrication of Gears

Lubricate all gears with silicone grease except 13-tooth idler gear (116), 130-tooth DH gear (115), DH knob gear (139), and tooth mesh of gear (131) with gearshaft (126). The excepted gears are electrofilmed and do not require lubrication.

6.2.35 Installation of Dust Cover

a. Install dust cover (3) and tighten two captive fasteners (4).
b. Install tape (2) over seam between bezel (67) and dust cover.



Motor Mounting Plate, Rear View
Figure 6

7. REPAIR

7.1 General

Standard repair procedures should be used unless special procedures and/or information are supplied in the paragraph.

7.2 Light Assembly Repair

a. Unsolder defective lamp and discard.
b. Solder new lamp to light assembly in position shown in figure 7.

7.3 Painting

All scratches, skinned areas, and worn painted surfaces should be retouched with paint specified in table 6.

8. ALIGNMENT/ADJUSTMENT

Note

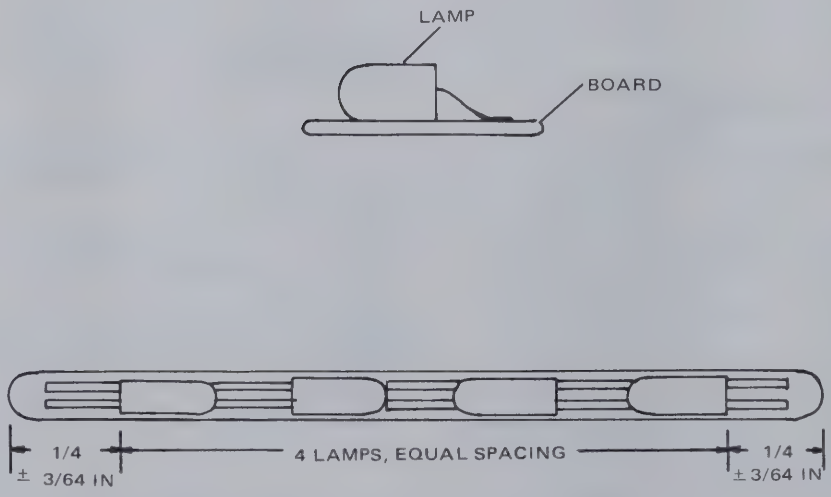
> All item numbers in parentheses refer to figure 1 in the 339H-4/4A Radio Altitude Indicator illustrated parts list section.

8.1 339H-4/4A Decision Height Adjustment

Note

> Perform steps a through h only if adjustment is not being made during assembly of indicator.

a. Remove dust cover as described in paragraph 6.1.3.
b. Remove four screws (25) that secure connector plate (21) to posts (26).
c. Remove four screws (13) that secure A1 (11) to posts.
d. Remove four screws (13) that secure A2 (12) to posts.
e. Carefully fold out A1, A2, and connector plate to allow access to rear of motor mounting plate (153).
f. Remove DH knob (57) and lighting assembly (64) as described in paragraphs 6.1.7 and 6.1.8.
g. Unsolder and tag wires connected to DH indicator (60).



NOTE: ON SOME UNITS THE 4 LAMPS WILL NOT POINT TO THE CENTER OF THE BOARD, BUT WILL POINT TO THE LEFT AND THE RIGHT ENDS.

TP3-7150-019

Light Assembly Repair
Figure 7

Table 6. Touchup Paint Chart.

PART	COLOR	FED-STD-595 COLOR NO	SWITZER BROS. INC. PART NO
Bezel	Gray	36118	
	Lusterless black	27038	
Decision height index	Fluorescent -- lightning yellow		207-46
Dial			
Background	Lusterless black	27038	
Markings	White	37875	
Dust cover	Gray	36118	
	Lusterless black	27038	
Mask			
Background	Lusterless black	27038	
Display	Lusterless black	27038	
Pointer			
Body	Lusterless black	27038	
Tip	Fluorescent -- ARC yellow		207-16
Warning flag	Fluorescent -- fire orange		207-14

h. Remove bezel (67) as described in paragraphs 6.1.9.a through 6.1.9.d.
i. Rotate gear train to low altitude end of travel.
j. Check that stop posts (41, 43) contact squarely and are in a line that is radial to potentiometer R1 (102) shaft.
k. Separate stops enough to insert 0.005-inch feeler gage.
l. Lock gear train in position to hold feeler gage between stops.
m. Loosen two setscrews (38) on output gear (37).
n. Connect ohmmeter between terminals 1 and 2 on motor mounting plate (153).
o. Rotate shaft of R1 to obtain minimum resistance indication and disconnect ohmmeter.
p. Position output gear (37) to mesh with small gear on DH stop gear (42). Adjustment must provide clearance for stops (41). Ensure that shaft of R1 does not move during positioning of output gear.
q. Tighten two setscrews (38).
r. Adjust DH knob shaft to center DH index on -20-foot altitude mark.
s. Loosen two setscrews (88) and adjust cam disc (86) cw to the precise trip point of DH switch S1 (35).
t. Tighten two setscrews (88).
u. Adjust DH knob shaft to stop at low altitude end of altitude range and observe that DH switch S1 closes (plunger in) between -20-foot altitude mark and stop. If switch does not close, the cam disc is improperly positioned axially. Loosen two setscrews and move disc closer to body at R1. Tighten two setscrews and repeat this step.
v. Adjust DH knob shaft to precise trip point of DH switch S1. Trip point can be heard as an audible click.
w. Loosen two screws (81) and align pointer (80) with center of DH index (113). Tighten two screws (81) and apply staking compound.
x. Remove feeler gage from between stops on output gear and DH stop gear.
y. Complete assembly procedure, or, if adjustment is not being made during assembly procedures, perform steps z through ae.
z. Solder wires to DH indicator (60).

aa. Install bezel (67), light assembly (64), and DH knob (57) as described in paragraphs 6.2.24, 6.2.25, and 6.2.26.
ab. Install terminal boards A1 (11) and A2 (12) as described in paragraphs 6.2.28 and 6.2.29.
ac. Install connector plate (24) and secure with four screws (25). Apply staking compound to four screws.
ad. Perform complete performance test as described in paragraph 4.
ae. Install dust cover (3) as described in paragraph 6.2.35.

8.2 339H-4 Altitude Adjustment

Note

Perform steps a through e only if adjustment is not being made during assembly of indicator.

a. Remove dust cover as described in paragraph 6.1.3.
b. Remove four screws (25) that secure connector plate (21) to posts (26).
c. Remove four screws (13) that secure A1 (11) to posts.
d. Remove four screws (13) that secure A2 (12) to posts.
e. Carefully fold out A1, A2, and connector plate to allow access to rear of motor mounting plate (153). Ensure that A1, A2, and connector plate are positioned to prevent shorting out of any components or bias voltages.
f. Perform pretest procedure as described in paragraph 4.2.
g. Adjust altitude signal to 0.400 ±0.01 V dc.
h. Loosen two screws (103) that secure R1 (102).
i. Rotate R1 to center pointer on 0-foot altitude mark.
j. Lightly tighten two screws (103). Ensure that R1 does not move during tightening of screws.
k. Adjust altitude signal to +14.90 ±0.01 V dc.
l. Adjust A1R2 to center pointer on 2,000-foot altitude mark.
m. Adjust altitude signal to +0.400 ±0.01 V dc.
n. Check that pointer is centered on 0-foot altitude mark. If pointer is not centered on 0-foot altitude mark, repeat steps h through n.
o. Hold R1 in position and tighten two screws (103).
p. Adjust altitude signal to +0.10 ±0.01 V dc.
q. Check that servo-motor B1 clutch does not slip. If clutch slips, loosen two screws (103) and very slightly rotate R1 to stop motor B1. Repeat steps h through q.
r. Adjust altitude signal to +18.50 +0.05, -0.000 V dc.
s. Check that servo-motor B1 clutch does not slip. If clutch slips, adjust A1R2 until motor stops and flag is out of view. Repeat steps h through s.
t. Complete assembly of indicator, or, if adjustment is not being made during indicator assembly, perform steps u through z.
u. Install A1 (11) and secure with four screws (13).
v. Install A2 (12) and secure with four screws (13).
w. Apply staking compound to eight screws (13).
x. Install connector plate (21) and secure with four screws (25).
y. Apply staking compound to four screws (25).
Perform complete performance test as described in paragraph 4.

8.3 339H-4A Altitude Adjustment

Note

Perform steps a through e only if adjustment is not being made during indicator assembly.

a. Remove dust cover as described in paragraph 6.1.3.
b. Remove four screws (25) that secure connector plate (21) to posts (26).
c. Remove four screws (13) that secure A1 (11) to posts.
d. Remove four screws (13) that secure A2 (12) to posts.
e. Carefully fold out A1, A2, and connector plate to allow access to rear of motor mounting plate (153). Ensure that A1, A2, and connector plate are positioned to prevent shorting out components or bias voltages.
f. Perform pretest procedure as described in paragraph 4.2.
g. Adjust A1R3 to 10 turns cw from maximum.
h. Adjust altitude signal to +0.400 ±0.02 V dc.

i. Adjust A1R4 to center pointer on 0-foot altitude mark.
j. Adjust altitude signal to +14.90 ±0.02 V dc.
k. Adjust A1R2 to center pointer on 2,000-foot altitude mark.
l. Adjust altitude signal to +2.400 ±0.02 V dc.
m. Adjust A1R3 to center pointer on 100-foot altitude mark.
n. Vary altitude signal between +2.200 and +2.600 V dc while observing pointer. Check for flat spot in linearity of R1, which occurs when a slight altitude signal change causes a 1-degree pointer shift.
o. Loosen two screws (103) that secure R1 (102).
p. Rotate R1 until flat spot is positioned with top edge at precisely 100-foot altitude mark and bottom edge is toward 0-foot end of scale.
q. Hold R1 in position and tighten two screws (103).
r. Adjust altitude signal to +0.400 ±0.01 V dc.
s. Adjust A1R4 to center pointer on 0-foot altitude mark.
t. Adjust altitude signal to +14.90 ±0.01 V dc.
u. Adjust A1R2 to center pointer on 2,000-foot altitude mark.
v. Adjust altitude signal +2.200 ±0.01 V dc.
w. Adjust A1R3 to center pointer on 90-foot altitude mark.
x. Repeat steps r through x until no further adjustments are required.
y. Complete assembly of indicator, or, if adjustment is not being made during indicator assembly, perform steps z through ae.
z. Install A1 (11) and secure with four screws (13).
aa. Install A2 (12) and secure with four screws (13).
ab. Apply staking compound to eight screws (13).
ac. Install connector plate (21) and secure with four screws (25).
ad. Apply staking compound to four screws (25).
ae. Perform complete performance test as described in paragraph 4.

9. DIFFERENCE DATA

9.1 General

Two different types of radio altitude indicators are covered in this section; the 339H-4 and the 339H-4A.

9.2 339H-4 Radio Altitude Indicator, CPN 622-1204-001, -003, -005

Provides altitude indications from 0 to 2,000 feet with 180 degrees of the dial scale providing altitudes from 0 to 500 feet in 10-foot increments and the next 80 degrees of the scale dial providing altitudes from 500 to 2,000 feet in 100-foot increments. The display lighting is +28 V dc.

9.3 339H-4 Radio Altitude Indicator, CPN 622-1204-002, -004, -006, -007, -008, -010

Identical to 339H-4 Radio Altitude Indicator, CPN 622-1204-001, except the display lighting is +5 V dc.

9.4 339H-4A Radio Altitude Indicator, CPN 622-1205-001, -003, -005

Provides altitude indications from 0 to 2,000 feet with 180 degrees of the dial scale providing altitudes from 0 to 100 feet in 5-foot increments and the next 115 degrees of the scale dial providing altitude from 100 to 2,000 feet in 50-foot increments. The display lighting is +28 V dc.

9.5 339H-4A Radio Altitude Indicator, CPN 622-1205-002, -004, -006

Identical to the 339H-4A Radio Altitude Indicator, CPN 622-1205-001, except the display lighting is +5 V dc.

Collins 339H-4/4A Radio Altitude Indicator

Rockwell
International

diagrams

Collins General Aviation Division

Printed in USA

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6th Edition, 15 January 1988

list of illustrations

Figure *Page*

1 339H-4/4A Radio Altitude Indicator, Schematic Diagram 3

NOTICE: This section replaces fifth edition dated 15 January 1985.

List of Effective Pages

*The asterisk indicates pages changed, added, or deleted by the current change.

Page No	Issue
*Title	15 Jan 88
*List of Effective Pages	15 Jan 88
1 thru 2	15 Jan 85
3 thru 4	1 Aug 77
5 thru 7	15 Feb 80
*8 thru 9	15 Jan 88
10 Blank	15 Feb 80

Record of Revisions

RETAIN THIS RECORD IN THE FRONT OF MANUAL.
ON RECEIPT OF REVISIONS, INSERT REVISED PAGES IN THE MANUAL, AND ENTER DATE INSERTED AND INITIALS.

REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED	REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED
1st Ed	1 Nov 73		None				
2nd Ed	1 Dec 74		None				
3rd Ed	1 Aug 77		339H-4: 1, 2, 3, 4 339H-4A: 1, 2, 3, 4, 5				
4th Ed	1 Feb 80		339H-4: 5 339H-4A: 6				
5th Ed	15 Jan 85		None				
6th Ed	15 Jan 88		None				

1. CONFIGURATION STATUS CONTROL

Collins General Aviation Division of Rockwell-International uses the following method for identifying the configuration status of a unit or subassembly.

A 2-character maximum alphabetic identifier will be preceded by the letters REV (revision) and will start with — (dash) if no changes have been processed. The first change will be identified as A, the second as B, and continuing through Y to AA, AB, and ultimately to YY (letters I, O, G, S, X, and Z are not used). Incorporation of design changes in a unit or subassembly that has been returned to Collins General Aviation Division for repair by a customer or that has been removed from the company's finished goods inventory is defined as rework. At the time of rework, the unit or subassembly will be re-marked to reflect the design level to which it is being upgraded. This is done by leaving the original marking on the unit or subassembly and adding the letters RWK (rework) followed by the alphabetic identifier of the latest change incorporated in the rework. For example, unit one is marked REV B — RWK F and unit two is marked REV F indicates that both units are at the design level of revision F but unit one is reworked and they may not look exactly the same.

Note

> A reworked unit may not contain all design changes made to the reworked identifier, but does contain all changes required to make unit operation identical to a newly manufactured unit with the same identifier. Therefore, a unit reworked to a specific identifier may physically appear different than a newly manufactured unit at the same alphabetic identifier.

Some units or subassemblies may use both methods of identifying the configuration status. In these units or subassemblies the latest identifier is the latest alphabetic identifier stamped on the unit or subassembly. A note on the schematic changes page will indicate when the switch from one method to the other method of identifying changes occurred.

Note

> The configuration identifier or alphabetic identifier is not a serial number because many units or subassemblies may exist with the same identifier.

Only configuration/alphabetic identifiers that result in schematic and parts breakdown changes are covered in this section. Therefore, if a unit or subassembly has an identifier that numerically/alphabetically falls between identifiers listed on the schematic change page, the electrical configuration is represented by the earlier identifier.

2. CONFIGURATION EFFECTIVITY

Refer to the schematic changes page preceding the schematic diagram for any changes that may have occurred and the corresponding identifier covering each change.

Listed are the units or subassemblies with the latest identifier (change) covered by this document.

UNIT/SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
339H-4	622-1204-001	U
339H-4	622-1204-002	U
339H-4	622-1204-003	U
339H-4	622-1204-004	U
339H-4	622-1204-005	U
339H-4	622-1204-006	U
339H-4	622-1204-007	U
339H-4	622-1204-008	U
339H-4	622-1204-010	U
339H-4A	622-1205-001	N
339H-4A	622-1205-002	N
339H-4A	622-1205-003	N

UNIT/SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
339H-4A	622-1205-004	N
339H-4A	622-1205-005	N
339H-4A	622-1205-006	N
A1	618-3690-001	T
A1	618-3690-002	R
A1 Circuit Card A1	618-3690-005	V
A1 Circuit Card A1	618-3690-007	V
A1	621-0834-001	N
A2	618-3691-001	J

3. SCHEMATIC DIAGRAM

The 339H-4/4A Radio Altitude Indicator schematic diagram is presented in figure 1. The schematic diagram A sheet provides a record of the schematic changes with revision identification. Sheet 1 of the schematic diagram is a listing of test point voltages available when specified input voltages are applied to the indicator.

SCHEMATIC CHANGES

REVISION IDENTIFICATION	DESCRIPTION OF REVISION AND REASON FOR CHANGE	SERVICE BULLETIN	EFFECTIVITY
A1, sheet 2	Replaces lighting board assembly 618-4088-001 with board assembly 618-4088-002 and connects the new board to pins A2-13 and A2-15 to change lighting from 28 to 5 volts.	1	CPN 622-1204-001 and 622-1205-001 that require 5-volt lighting. All CPN 622-1204-002 and 622-1205-002
A2, sheet 2	Added capacitor A1C7, 2.3 μF, in feedback circuit of operational amplifier A1U2B to eliminate responses to short-duration (0.5 second or less) voltage changes on the altitude signal line.	2	CPN 622-1204-001, serno 218 and above CPN 622-1204-002, serno 721 and above CPN 622-1205-001, serno 12 and above
A3 (Cont)	Added capacitor C8, 0.01 μF, and capacitor C9, 0.01 μF, from motor terminals to motor case to eliminate effects of emi noise generated by the motor.	339H-4 SB 3 and 339H-4A SB 4	CPN 622-1204-001, serno 1553 and above CPN 622-1204-002, serno 1680 and above CPN 622-1204-003, serno 901, 927, 932, 934, 936, 975, 976, 980, 981, 1055 thru 1060, 1062, 1104 and above (except 1422 thru 1434)

339H-4/4A Radio Altitude Indicator, Schematic Diagram
Figure 1 (Sheet A)

SCHEMATIC CHANGES

REVISION IDENTIFICATION	DESCRIPTION OF REVISION AND REASON FOR CHANGE	SERVICE BULLETIN	EFFECTIVITY
A3 (Cont)			CPN 622-1204-004, serno 1521 thru 1534, 1581, 1605 and above CPN 622-1204-005, serno 2186 and above CPN 622-1204-006, serno 2186 and above CPN 622-1204-007, serno 1632 and above CPN 622-1205-001 thru -006, serno 82 and above
A4	Connector J1 CPN 371-8087-000 replaced with connector CPN 371-9036-010 having rf filters to prevent erroneous altitude readings from induced radio frequency.	339H-4A SB 3	622-1205-001, -002, -003, and -004, serno 82 and above 622-1205-005, and -006, all models
B1	Added capacitor C10, 0.47 μF, to prevent high-frequency servo-amplifier oscillations.	339H-4 SB 4 and 339H-4A SB 5	CPN 622-1204-001, serno 2086 and above CPN 622-1204-002, serno 2061 and above
(Cont)			

339H-4/4A Radio Altitude Indicator, Schematic Diagram
Figure 1 (Sheet B)

SCHEMATIC CHANGES

REVISION IDENTIFICATION	DESCRIPTION OF REVISION AND REASON FOR CHANGE	SERVICE BULLETIN	EFFECTIVITY
B1 (Cont)			CPN 622-1204-003, serno 1135, 1145, 1146, 1161 and above (except 1422 thru 1434) CPN 622-1204-004, serno 1616, 2106 and above CPN 622-1204-005, serno 2186 and above CPN 622-1204-006, serno 2186 and above CPN 622-1204-007, serno 1648, 1662, 1663, 1665, 1668 and above CPN 622-1205-001 thru -006, serno 82 and above
C1 (Cont)	Added altitude clamp circuit consisting of A1Q6, A1R38, R39 to prevent gear wear.	339H-4 SB 5 and 339H-4A SB 6	CPN 622-1204-001, -005, -006, -007, serno 3915 and above; CPN 622-1205-002, serno 3891 and above; CPN 622-1205-003, serno 3562 and above;

339H-4/4A Radio Altitude Indicator, Schematic Diagram
Figure 1 (Sheet C)

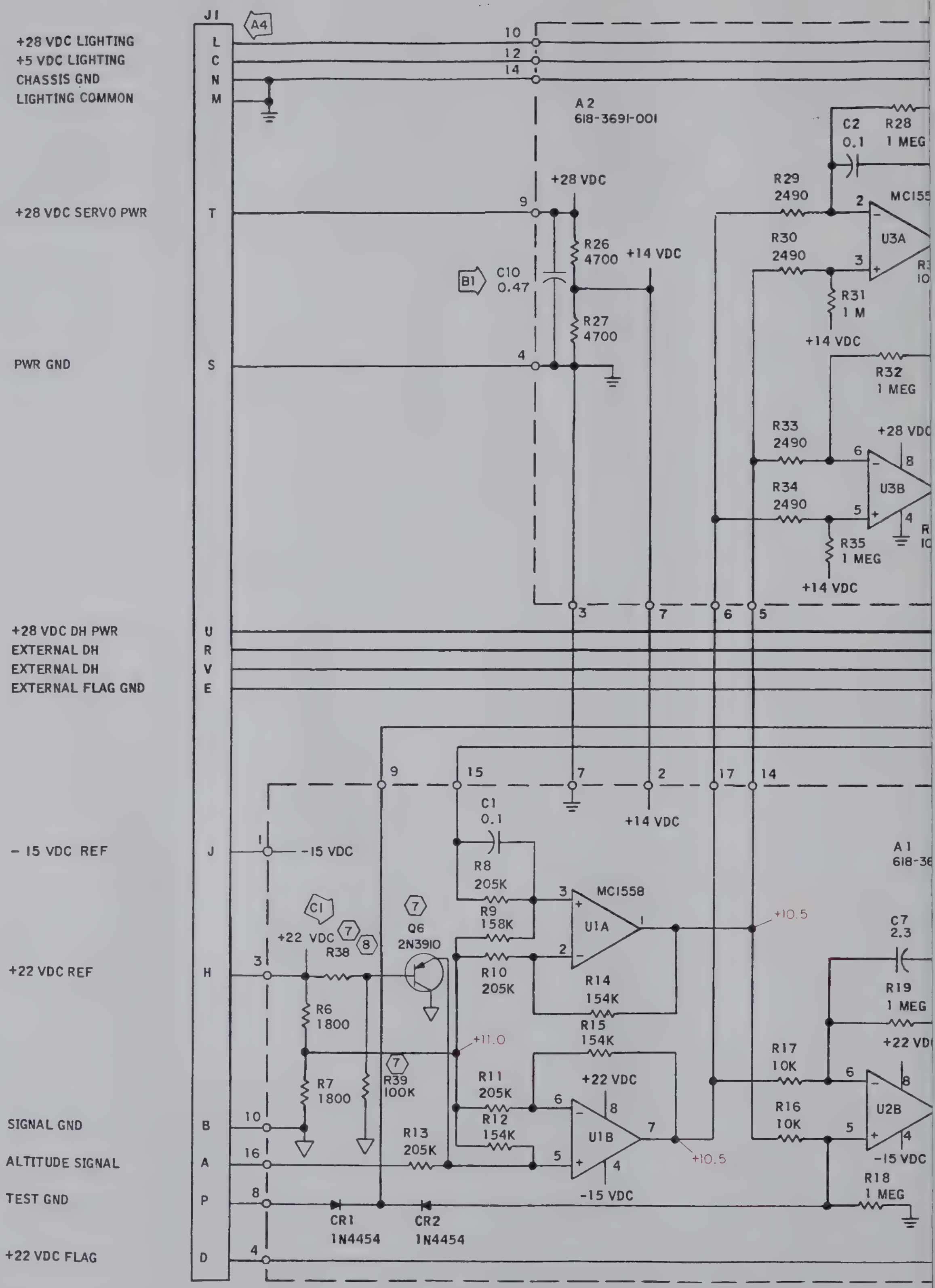
SCHEMATIC CHANGES

REVISION IDENTIFICATION	DESCRIPTION OF REVISION AND REASON FOR CHANGE	SERVICE BULLETIN	EFFECTIVITY
C1 (Cont)			CPN 622-1205-004, serno 3321 and above; CPN 622-1205-008, serno 3515 and above.
			CPN 622-1205-001, serno 275; CPN 622-1205-002, serno 195; CPN 622-1205-003, serno 300; CPN 622-1205-004, serno 320; CPN 622-1205-005 and -006, serno 330 and above
			A1 CPN 618-3690-001, REV K; A1 CPN 618-3690-002, REV L

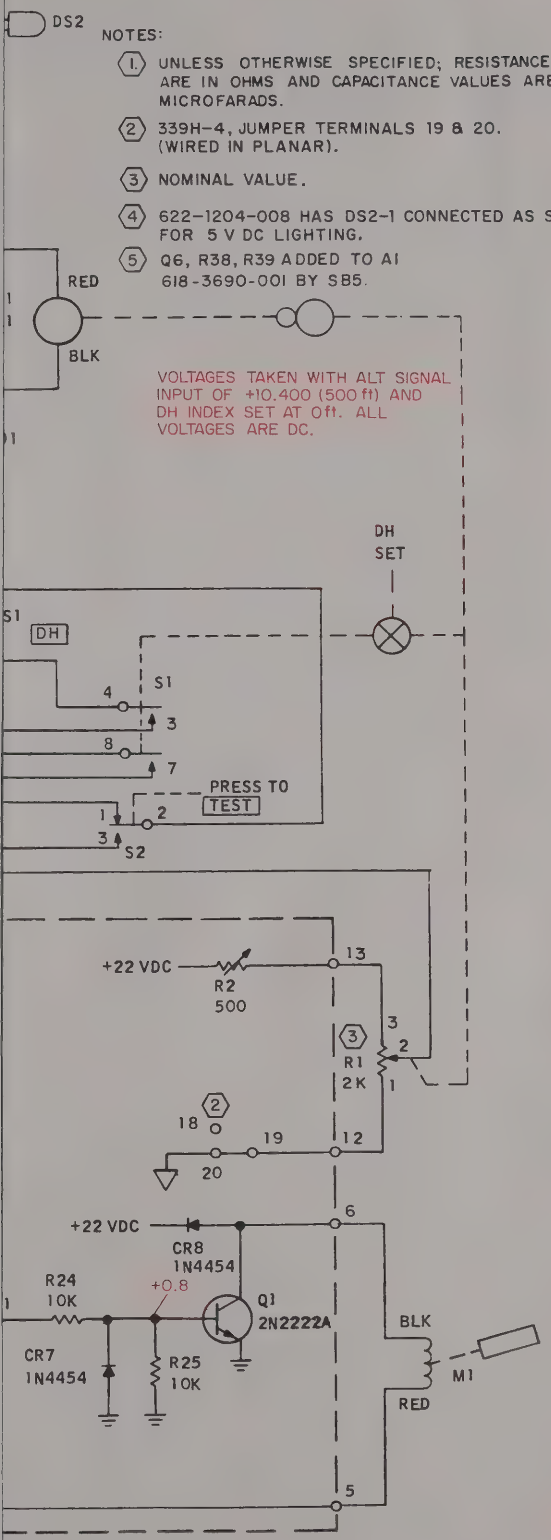
339H-4/4A Radio Altitude Indicator, Schematic Diagram
Figure 1 (Sheet D)

TEST POINT	NOMINAL VDC	TEST POINT	NOMINAL VDC
ALT SIG INPUT = +10.400 VDC (500 ft). DH INDEX SET AT 0 ft.			
A1R6, A1R7	+11.0	B1-RED	+12.0
A1U1-1	+10.5	B1-BLK	+13.8
A1U1-2	+10.6		
A1U1-3	+10.7		
A1U1-4	-15.0		
A1U1-5	+10.6		
A1U1-6	+10.7		
A1U1-7	+10.5		
A1U1-8	+22.0		
A1U2-1	+21.2		
A1U2-2	-3.9		
A1U2-3	+3.8		
A1U2-4	-15.0		
A1U2-5	+10.4		
A1U2-6	+10.4		
A1U2-7	+0.3		
A1U2-8	+22.0		
A1Q1-B	+0.8		
A1Q1-E	0.0		
A1Q1-C	0.0		
A2R26, A2R27	+14.0		
A2U3-1	+14.3		
A2U3-2	+10.6		
A2U3-3	+10.6		
A2U3-4	0.0		
A2U3-5	+10.6		
A2U3-6	+10.6		
A2U3-7	+11.5		
A2U3-8	+28.0		
A2Q2-B	+14.3	TEST SWITCH DEPRESSED	
A2Q2-E	+13.8	A1U2-1	-13.0
A2Q2-C	+28.0	A1U2-2	-4.0
A2Q3-B	+14.3	A1U2-3	-6.3
A2Q3-E	+13.8	A1U2-4	-15.0
A2Q3-C	0.0	A1U2-5	-0.6
A2Q4-B	+11.5	A1U2-6	+10.2
A2Q4-E	+12.0	A1U2-7	-13.0
A2Q4-C	0.0	A1U2-8	+22.0
A2Q5-B	+11.5	A1Q1-B	+0.5
A2Q5-E	+12.0	A1Q1-E	0.0
A2Q5-C	+28.0	A1Q1-C	+22.0

339H-4/4A Radio Altitude Indicator, Schematic Diagram
Figure 1 (Sheet 1 of 3)


J1
A4
+28 VDC LIGHTING
+5 VDC LIGHTING
CHASSIS GND
LIGHTING COMMON
L
C
N
M
10
12
14
A2
618-3691-001
C2
0.1
R28
1 MEG
+28 VDC
R29
2490
MC155
+28 VDC SERVO PWR
T
9
R26
4700
+14 VDC
R30
2490
U3A
B1
C10
0.47
R31
1 M
R27
4700
+14 VDC
PWR GND
S
4
R32
1 MEG
R33
2490
+28 VDC
U3B
R34
2490
R35
1 MEG
+14 VDC
3
7
6
5
+28 VDC DH PWR
EXTERNAL DH
EXTERNAL DH
EXTERNAL FLAG GND
U
R
V
E
9
15
7
2
17
14
C1
0.1
+14 VDC
− 15 VDC REF
J
1
−15 VDC
A1
618-36
R8
205K
MC1558
R9
158K
U1A
+10.5
C7
2.3
C1
7
Q6
2N3910
+22 VDC
8
R38
R10
205K
R14
154K
R19
1 MEG
+22 VDC REF
H
R6
1800
R15
154K
+11.0
+22 VDC
R17
10K
R7
1800
7
R39
100K
R11
205K
+22 VDC
U2B
R12
154K
R16
10K
SIGNAL GND
B
10
R13
205K
U1B
+10.5
ALTITUDE SIGNAL
A
16
−15 VDC
TEST GND
P
8
CR1
1N4454
CR2
1N4454
−15 VDC
R18
1 MEG
+22 VDC FLAG
D
4

339H-4/4A Radio Altitude Indicator, Schematic Diagram
Figure 1 (Sheet 2)


DS2
RED
1
1
BLK
1
DH
SET
S1
DH
4
S1
3
8
7
PRESS TO
TEST
1
2
3
S2
+22 VDC
R2
500
13
3
3
2
R1
2K
1
2
18
19
12
20
+22 VDC
6
CR8
1N4454
R24
10K
+0.8
Q1
2N2222A
1
CR7
1N4454
R25
10K
BLK
M1
RED
5

NOTES:

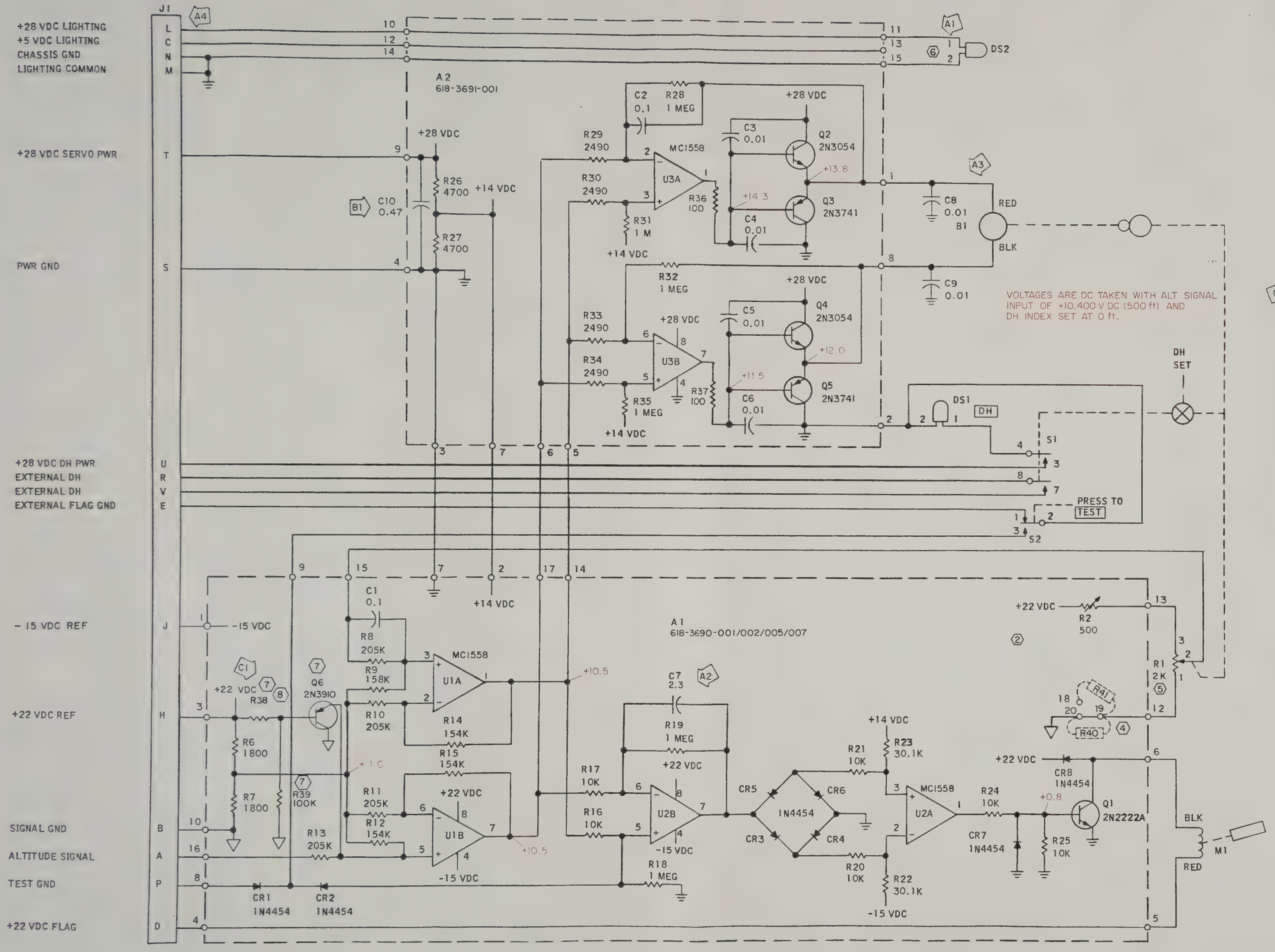
1. UNLESS OTHERWISE SPECIFIED; RESISTANCE VALUES ARE IN OHMS AND CAPACITANCE VALUES ARE IN MICROFARADS.
2. 339H-4, JUMPER TERMINALS 19 & 20. (WIRED IN PLANAR).
3. NOMINAL VALUE.
4. 622-1204-008 HAS DS2-1 CONNECTED AS SHOWN FOR 5 V DC LIGHTING.
5. Q6, R38, R39 ADDED TO A1 618-3690-001 BY SB5.

VOLTAGES TAKEN WITH ALT SIGNAL INPUT OF +10.400 (500 ft) AND DH INDEX SET AT 0ft. ALL VOLTAGES ARE DC.

GAO-0353-014-0

637-8763

339H-4/4A Radio Altitude Indicator, Schematic Diagram
Figure 1 (Sheet 3)



J1
A4
+28 VDC LIGHTING
+5 VDC LIGHTING
CHASSIS GND
LIGHTING COMMON
L
C
N
M
A2
618-3691-001
A1
DS2
+28 VDC SERVO PWR
PWR GND
+28 VDC
+14 VDC
B1
C10
0.47
R26
4700
R27
4700
C2
0.1
R28
1 MEG
R29
2490
R30
2490
R31
1 M
MC1558
U3A
R36
100
C3
0.01
Q2
2N3054
+13.8
+14.3
C4
0.01
Q3
2N3741
A3
C8
0.01
RED
B1
BLK
C9
0.01
R32
1 MEG
R33
2490
R34
2490
R35
1 MEG
U3B
R37
100
C5
0.01
Q4
2N3054
+12.0
+11.5
C6
0.01
Q5
2N3741
DS1
DH
S1
DH SET
VOLTAGES ARE DC TAKEN WITH ALT SIGNAL INPUT OF +10.400 V DC (500 ft) AND DH INDEX SET AT 0 ft.
+28 VDC DH PWR
EXTERNAL DH
EXTERNAL DH
EXTERNAL FLAG GND
U
R
V
E
PRESS TO TEST
S2
- 15 VDC REF
J
-15 VDC
C1
0.1
R8
205K
R9
158K
R10
205K
MC1558
U1A
R14
154K
R15
154K
+10.5
A1
618-3690-001/002/005/007
C1
+22 VDC
R38
Q6
2N3910
R6
1800
R7
1800
R39
100K
+22 VDC REF
H
+1.0
R11
205K
R12
154K
U1B
+10.5
R13
205K
SIGNAL GND
ALTITUDE SIGNAL
TEST GND
+22 VDC FLAG
B
A
P
D
CR1
1N4454
CR2
1N4454
C7
2.3
A2
R19
1 MEG
R17
10K
R16
10K
U2B
R18
1 MEG
CR5
CR6
CR3
CR4
1N4454
R21
10K
R23
30.1K
R20
10K
R22
30.1K
+14 VDC
-15 VDC
MC1558
U2A
R24
10K
+0.8
CR8
1N4454
CR7
1N4454
R25
10K
Q1
2N2222A
+22 VDC
R2
500
R1
2K
R41
R40
BLK
RED
M1

NOTES:

① UNLESS OTHERWISE SPECIFIED; RESISTANCE VALUES ARE IN OHMS AND CAPACITANCE VALUES ARE IN MICROFARADS.

② SCHEMATIC ILLUSTRATES THE POSITION FEEDBACK POTENTIOMETER CIRCUITRY FOR THE 339H-4. DETAIL A ILLUSTRATES CIRCUITRY FOR THE 339H-4A.

③ AIR3, R4, R5 ADDED FOR 339H-4 ON 618-3690-002/005.

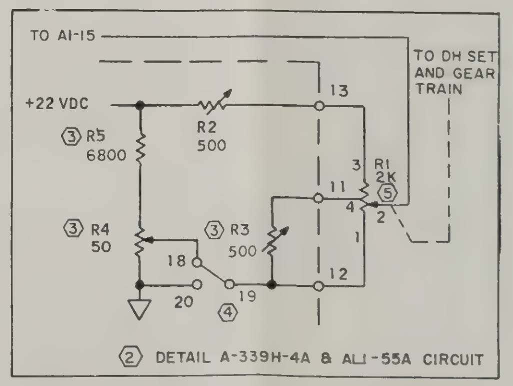
④ 339H-4 JUMPER TERMINALS 19 AND 20 (WIRED IN PLANAR ON A1 618-3690-001; R40 ON A1 618-3690-007). 339H-4A, REMOVE JUMPER BETWEEN 19 AND 20, ADD JUMPER (IN PLANAR ON A1 618-3690-002; R41 ON A1 618-3690-005) BETWEEN 18 AND 20.

⑤ NOMINAL VALUE

⑥ 622-1204-001, -003, -005; 622-1205-001, -003, -005; HAVE DS2-1 CONNECTED TO A2-11 AS SHOWN FOR +28 V DC LIGHTING. 622-1204-002, -004, -006, -007, -010; 622-1205-002, -004, -006 HAVE DS2-1 CONNECTED TO A2-13 (INSTEAD OF A2-11) FOR +5 V DC LIGHTING.

⑦ A1Q6, R38, R39 ADDED TO 618-3690-001 FOR 339H-4 (SB5), AND TO 618-3690-002 FOR 339H-4A (SB6).

C1 ⑧ VALUES FOR R38 ARE 64.9 K FOR 618-3690-001, -007 AND 63.4 K FOR 618-3690-002.

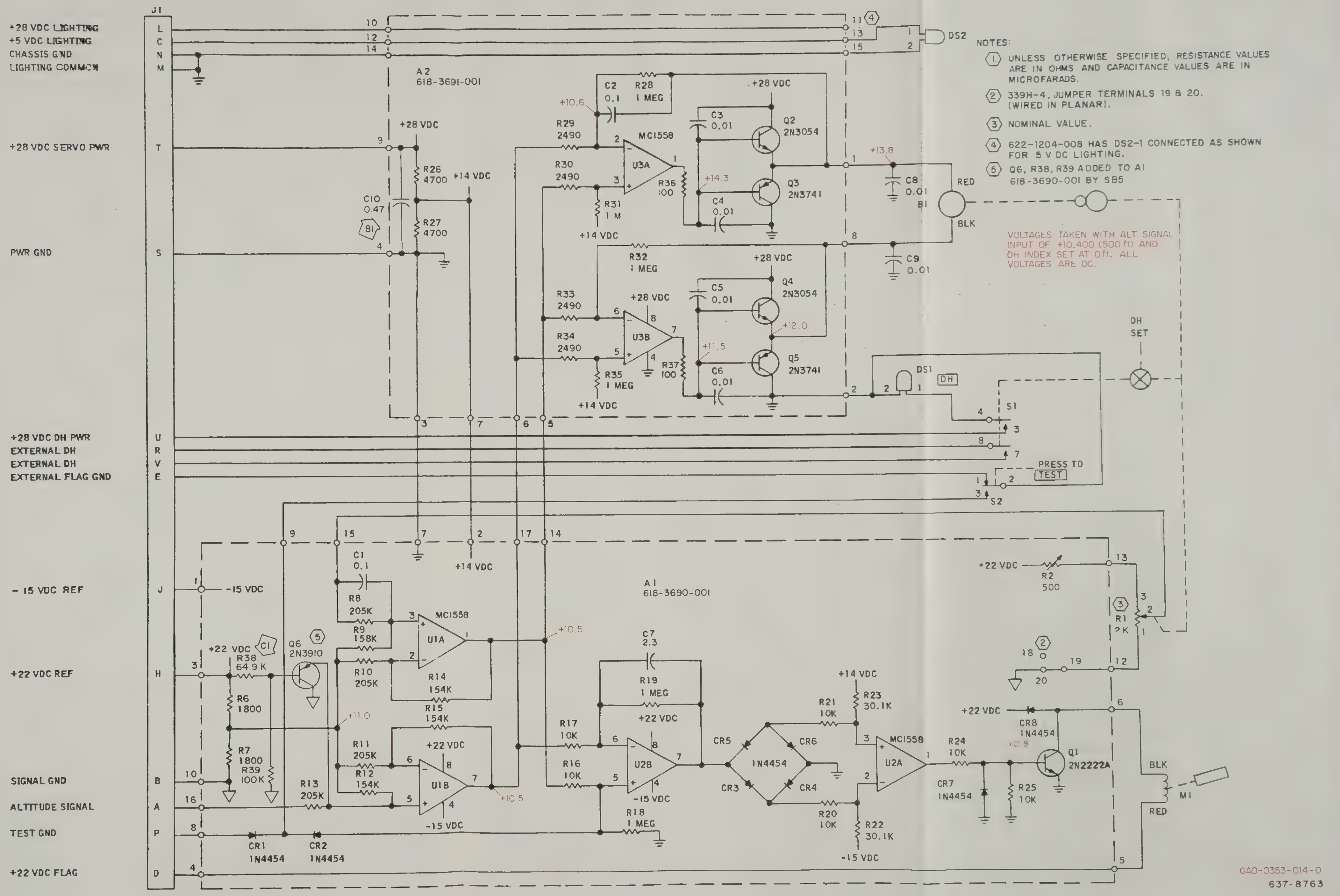


TO A1-15
TO DH SET AND GEAR TRAIN
+22 VDC
R5
6800
R2
500
R1
2K
R4
50
R3
500
13
11
12
18
20
19

② DETAIL A-339H-4A & ALI-55A CIRCUIT

GA0-0358-024-0
621-3259-001

339H-4/4A Radio Altitude Indicator, Schematic Diagram
Figure 1 (Sheet 2)


J1
+28 VDC LIGHTING
+5 VDC LIGHTING
CHASSIS GND
LIGHTING COMMON
+28 VDC SERVO PWR
PWR GND
+28 VDC DH PWR
EXTERNAL DH
EXTERNAL DH
EXTERNAL FLAG GND
− 15 VDC REF
+22 VDC REF
SIGNAL GND
ALTITUDE SIGNAL
TEST GND
+22 VDC FLAG
L
C
N
M
T
S
U
R
V
E
J
H
B
A
P
D
A2
618-3691-001
DS2
C10
0.47
B1
R26
4700
R27
4700
+28 VDC
+14 VDC
C2
0.1
R28
1 MEG
+10.6
R29
2490
R30
2490
R31
1 M
MC1558
U3A
R36
100
C3
0.01
Q2
2N3054
Q3
2N3741
C4
0.01
+14.3
+13.8
C8
0.01
RED
BLK
B1
R32
1 MEG
R33
2490
R34
2490
R35
1 MEG
U3B
R37
100
C5
0.01
Q4
2N3054
Q5
2N3741
C6
0.01
+12.0
+11.5
C9
0.01
DS1
DH
S1
PRESS TO
TEST
S2
DH
SET
A1
618-3690-001
C1
0.1
R8
205K
R9
158K
R10
205K
R14
154K
R15
154K
U1A
U1B
R11
205K
R12
154K
R13
205K
+10.5
+11.0
−15 VDC
+22 VDC
C1
Q6
2N3910
R38
64.9 K
R6
1800
R7
1800
R39
100K
CR1
1N4454
CR2
1N4454
C7
2.3
R19
1 MEG
R17
10K
R16
10K
R18
1 MEG
U2B
CR5
CR6
CR3
CR4
1N4454
R21
10K
R20
10K
R23
30.1K
R22
30.1K
U2A
R24
10K
CR7
1N4454
R25
10K
CR8
1N4454
Q1
2N2222A
+0.8
R2
500
R1
2K
M1
BLK
RED
GA0-0353-014-0
637-8763

NOTES:

1. UNLESS OTHERWISE SPECIFIED; RESISTANCE VALUES ARE IN OHMS AND CAPACITANCE VALUES ARE IN MICROFARADS.
2. 339H-4, JUMPER TERMINALS 19 & 20. (WIRED IN PLANAR).
3. NOMINAL VALUE.
4. 622-1204-008 HAS DS2-1 CONNECTED AS SHOWN FOR 5 V DC LIGHTING.
5. Q6, R38, R39 ADDED TO A1 618-3690-001 BY SB5

VOLTAGES TAKEN WITH ALT SIGNAL INPUT OF +10.400 (500 ft) AND DH INDEX SET AT Off. ALL VOLTAGES ARE DC.

339H-4/4A Radio Altitude Indicator, Schematic Diagram
Figure 1 (Sheet 3)

Rockwell
International

Collins 339H-4/4A
Radio Altitude Indicator

parts list

Collins General Aviation Division

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list of illustrations

Figure *Page*

1 339H-4/4A Radio Altitude Indicator, Exploded View 6
2 Circuit Card Assembly A1 (CPN 618-3690-001, -002), Component Location Diagram 7
3 Circuit Card Assembly A1 (CPN 618-3690-005, -007), Component Location Diagram 8
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List of Effective Pages

*The asterisk indicates pages changed, added, or deleted by the current change.

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*List of Effective Pages	15 Sep 88
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10 Blank	15 Jan 85

Record of Revisions

RETAIN THIS RECORD IN THE FRONT OF MANUAL.
ON RECEIPT OF REVISIONS, INSERT REVISED PAGES IN THE MANUAL, AND ENTER DATE INSERTED AND INITIALS.

REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED	REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED
1st Ed	1 Aug 73		None				
2nd Ed	1 Dec 74		None				
3rd Ed	1 Aug 77		1, 2, 3, 4				
4th Ed	15 Feb 80		1, 2, 3, 4, 5, 6				
5th Ed	15 Jan 85		None				
6th Ed	15 Jan 88		None				
1st Rev	15 Sep 88		None				

parts list

1. CONFIGURATION CONTROL

Collins General Aviation Division of Rockwell International uses the following method for identifying the configuration status of a unit or subassembly.

A 2-character maximum alphabetic identifier will be preceded by the letters REV (revision) and will start with — (dash) if no changes have been processed. The first change will be identified as A, the second as B, continuing through Y to AA, AB, and ultimately to YY (letters I, O, Q, S, X, and Z are not used).

Incorporation of design changes in a unit or subassembly that has been returned to Collins General Aviation Division for repair by a customer or that has been removed from the company's finished goods inventory is defined as rework. At the time of rework, the unit or subassembly will be marked again to reflect the design level to which it is being upgraded. This is done by leaving the original marking on the unit or subassembly and adding the letters RWK (rework) followed by the alphabetic identifier of the latest change incorporated in the rework. For example, unit one is marked REV B — RWK F, and unit two is marked REV F. This indicates that both units are at the design level of revision F, but unit one is reworked and they may not look exactly the same.

Note

> A reworked unit may not contain all design changes made to the reworked identifier but does contain all changes required to make unit operation identical to a newly manufactured unit with the same identifier. Therefore, a unit reworked to a specific identifier may physically appear different from a newly manufactured unit with the same alphabetic identifier.

Only alphabetic identifiers that result in schematic changes are covered in this section. If a unit or subassembly has an identifier that alphabetically falls between identifiers up to and including the latest effectivity listed in paragraph 3, the electrical configuration is represented by the earlier identifier.

2. DIAGRAMS

A schematic diagram for the 339H-4/4A is provided in diagrams section figure 1. An exploded view diagram for the 339H-4/4A is shown in figure 1 and circuit cards A1 and A2 are shown in figures 2, 3, and 4.

3. CONFIGURATION EFFECTIVITY

Listed below are the units or subassemblies with the latest identifier (change) covered by this section.

UNIT/SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
339H-4	622-1204-0XX	REV U
339H-4A	622-1205-00X	REV N
Radio Altitude Indicator Subassembly	618-5434-0XX	REV AF
Circuit Card A1	618-3690-001	REV T
Circuit Card A1	618-3690-002	REV R
Circuit Card A1	618-3690-005	REV V
Circuit Card A1	618-3690-007	REV V
Circuit Card A1	621-0834-001	REV N
Circuit Card A2	618-3691-001	REV J
Wiring Harness	618-5439-001	REV D
Wiring Harness	618-5439-002	REV D
Wiring Harness	618-5439-003	REV D
Wiring Harness	618-5439-004	REV D

4. USED ON CODES

4.1 Top Level Configuration

A used on code (A, B, C, etc) is provided in the table below to identify subassembly variations within the 339H-4/4A. A code letter is assigned to each top level part number. Any subassembly unique to that top level number is assigned the same code letter. Absence of a code letter indicates that the subassembly applies to all units.

UNIT/SUBASSEMBLY	COLLINS PART NUMBER	USED ON CODE
339H-4	622-1204-001	A
339H-4	622-1204-002	B
339H-4A	622-1205-001	C
339H-4	622-1204-007	D
339H-4	622-1204-003	E
339H-4	622-1204-004	F
339H-4	622-1204-005	G
339H-4	622-1204-006	H
339H-4	622-1204-008	J
339H-4A	622-1205-002	K
339H-4A	622-1205-003	L
339H-4A	622-1205-004	M
339H-4A	622-1205-005	N
339H-4A	622-1205-006	P
339H-4A	622-1205-010	Q
Radio Altitude Indicator Subassembly	618-5434-001	A
Radio Altitude Indicator Subassembly	618-5434-002	C
Radio Altitude Indicator Subassembly	618-5434-003	B
Radio Altitude Indicator Subassembly	618-5434-004	K
Radio Altitude Indicator Subassembly	618-5434-005	E
Radio Altitude Indicator Subassembly	618-5434-006	F, J
Radio Altitude Indicator Subassembly	618-5434-007	L
Radio Altitude Indicator Subassembly	618-5434-008	M
Radio Altitude Indicator Subassembly	618-5434-009	G
Radio Altitude Indicator Subassembly	618-5434-010	H
Radio Altitude Indicator Subassembly	618-5434-011	N
Radio Altitude Indicator Subassembly	618-5434-012	P
Radio Altitude Indicator Subassembly	618-5434-013	D
Radio Altitude Indicator Subassembly	618-5434-014	Q
Circuit Card A1	618-3690-001	A, B, D, E, F, G, H, J, Q
Circuit Card A1	618-3690-002	C, K, L, M, N, P
Circuit Card A1	618-3690-005	A, B, D, E, F, G, H, J, Q
Circuit Card A1	618-3690-007	C, K, L, M, N, P
Circuit Card A1	621-0834-001	C, K
Circuit Card A2	618-3691-001	
Wiring Harness	618-5439-001	A, E, G
Wiring Harness	618-5439-002	B, D, F, H, J, Q
Wiring Harness	618-5439-003	C, L, N
Wiring Harness	618-5439-004	K, M, P

4.2 Subassembly Configuration

The parts list for each subassembly contains a USED ON CODE column. This column is used when a parts list covers more than one part number of a subassembly. Then a used on code letter (A, B, C, etc) is assigned to each subassembly part number. A component not common to every subassembly is coded with the same letter as the subassembly it is used on. Absence of a code letter indicates that the part applies to all subassemblies.

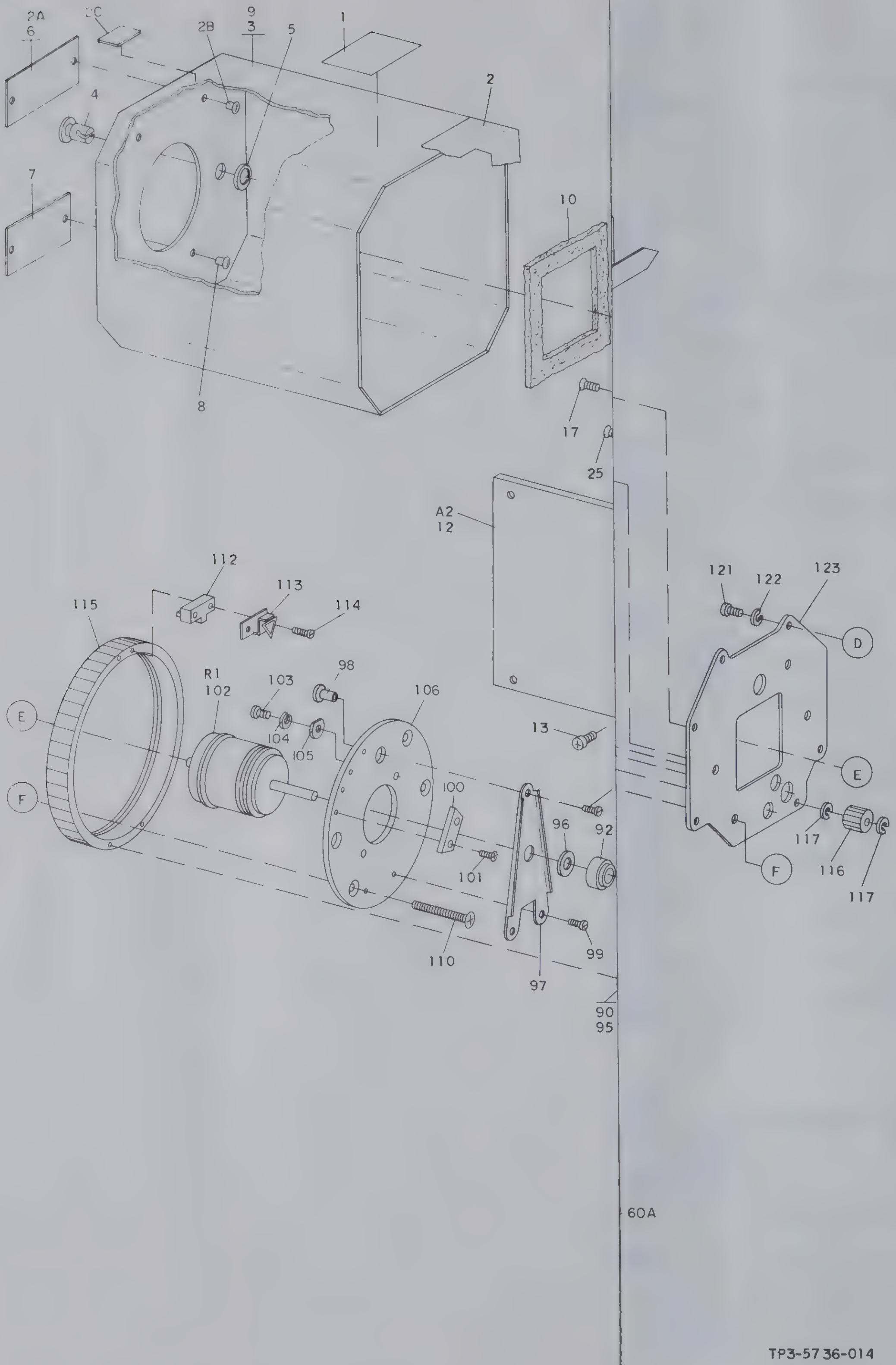
PARTS LIST
339H-4/4A Radio Altitude Indicator

SYMBOL	DESCRIPTION	USED ON CODE	COLLINS PART NUMBER	LOC
	Indicator, radio altitude 339H-4	A	622-1204-001	
	Indicator, radio altitude 339H-4	B	622-1204-002	
	Indicator, radio altitude 339H-4A	C	622-1205-001	
	Indicator, radio altitude 339H-4	D	622-1204-007	
	Indicator, radio altitude 339H-4	E	622-1204-003	
	Indicator, radio altitude 339H-4	F	622-1204-004	
	Indicator, radio altitude 339H-4	G	622-1204-005	
	Indicator, radio altitude 339H-4	H	622-1204-006	
	Indicator, radio altitude 339H-4	J	622-1204-008	
	Indicator, radio altitude 339H-4A	K	622-1205-002	
	Indicator, radio altitude 339H-4A	L	622-1205-003	
	Indicator, radio altitude 339H-4A	M	622-1205-004	
	Indicator, radio altitude 339H-4A	N	622-1205-005	
	Indicator, radio altitude 339H-4A	P	622-1205-006	
	Indicator, radio altitude 339H-4A	Q	622-1205-010	
	Indicator, radio altitude subassembly	A	618-5434-001	
	Indicator, radio altitude subassembly	B	618-5434-003	
	Indicator, radio altitude subassembly	C	618-5434-002	
	Indicator, radio altitude subassembly	D	618-5434-013	
	Indicator, radio altitude subassembly	E	618-5434-005	
	Indicator, radio altitude subassembly	F,J	618-5434-006	
	Indicator, radio altitude subassembly	G	618-5434-009	
	Indicator, radio altitude subassembly	H	618-5434-010	
	Indicator, radio altitude subassembly	K	618-5434-004	
	Indicator, radio altitude subassembly	L	618-5434-007	
	Indicator, radio altitude subassembly	M	618-5434-008	
	Indicator, radio altitude subassembly	N	618-5434-011	
	Indicator, radio altitude subassembly	P	618-5434-012	
	Indicator, radio altitude subassembly	Q	618-5434-014	
1	Plate, instruction		280-3441-000	
2	Tape, pressure sensitive (use as required)		014-1198-000	
2A	Plate, identification (eff REV B)	A,B,D, E,F,G, H,J,Q	609-7493-000	
2A	Plate, identification (eff REV B)	C,K,L, M,N,P	609-7512-000	
2B	Rivet, 3/32 x 3/32 (AP)		305-1754-000	
2C	Label (eff SB 1)	A,C	280-2513-000	
3	Cover, indicator	A,B,D, G,H,Q	618-1318-001	
3	Cover, indicator (eff to REV L)	C,K,N,P	618-1318-002	
3	Cover, indicator (eff REV L)	C,K,N,P	618-1318-001	
3	Indicator, cover (eff to REV L)	E,F	618-1318-003	
3	Cover, indicator (eff to REV L)	L,M	618-1318-004	
3	Cover, indicator (eff REV L)	E,F,L,M	618-1318-002	
3	Cover, indicator	J	618-1318-002	

PARTS LIST
Radio Altitude Subassembly (CPN 618-5434-0XX)

SYMBOL	DESCRIPTION	USED ON CODE	COLLINS PART NUMBER	LOC
	Indicator, radio altitude subassembly	A	618-5434-001	
	Indicator, radio altitude subassembly	B	618-5434-003	
	Indicator, radio altitude subassembly	C	618-5434-002	
	Indicator, radio altitude subassembly	D	618-5434-013	
	Indicator, radio altitude subassembly	E	618-5434-005	
	Indicator, radio altitude subassembly	F,J	618-5434-006	
	Indicator, radio altitude subassembly	G	618-5434-009	
	Indicator, radio altitude subassembly	H	618-5434-010	
	Indicator, radio altitude subassembly	K	618-5434-004	
	Indicator, radio altitude subassembly	L	618-5434-007	
	Indicator, radio altitude subassembly	M	618-5434-008	
	Indicator, radio altitude subassembly	N	618-5434-011	
	Indicator, radio altitude subassembly	P	618-5434-012	
4	Stud, turnlock fstnr, CD PL STL 0.187 X 0.260		012-1013-000	
5	Ring, retaining (AP) (eff to REV C)		012-9002-000	
5	Ring, retaining (AP) (eff REV C)		340-1884-010	
6	Plate, identification (eff to REV B)	A,B,C, D,J,K, L,M,N, P	609-7493-000	
6	Plate, identification (eff to REV B)	E,F,G,H	609-7512-000	
7	Plate, modification information		791-8387-001	
8	Rivet, 3/32 x 3/32 (AP) (Qty 2)		305-1754-000	
9	Cover	A,B,C, D,J,K, L,M,N, P	609-4772-001	
9	Cover (eff to REV D)	E,F,G,H	609-4772-001	
9	Cover (eff REV D)		609-4772-003	
10	Tape, foam (AP)		014-1311-020	
11	Circuit card assembly A1 (Eff to Rev AD)	A,C,E, F,J,K, N,P	618-3690-001	
11A	Circuir card assembly A1 (eff REV D to REV G)	B,D	621-0834-001	
11A	Circuit card assembly A1 (eff REV G to REV K)	B,D	618-3690-002	
11A	Circuit card assembly A1 (eff REV K to REV AD)	B,D,G, H,L,M	618-3690-002	
11A	Circuit card assembly A1 (eff REV AD)	B,D,G, H,L,M	618-3690-005	
11A	Circuit card assembly A1 (eff REV AD)	A,C,E, F,J,K, N,P	618-3690-007	
11B	Res, var, 500Ω, 5%, 3/4W A1R3	B	381-1798-000	
11C	Res, var, 20Ω, 5%, 3/4W A1R4	B	381-1794-000	
11D	Res, cc, 6.8kΩ, 10%, 1/4W A1R5	B	745-0779-000	
11E	Res, var, 500Ω, 10%, 3/4W A1R3 (eff to REV E)	B,D,G, H,L,M	380-3773-150	
11E	Res, var, 500Ω, 10%, 1/4W A1R3 (eff REV E)	B,D,G, H,L,M	380-3773-020	
11F	Res, var, 50Ω, 5%, 1/2W A1R4	B,D,G, H,L,M	381-1272-000	
11G	Res, var, 500Ω, 10%, 1/4W A1R5	B,D,G, H,L,M	380-3773-020	
12	Circuit card assembly A2		618-3691-001	
13	Screw, pph, 2-56 x 3/16 (AP for 10-11) (Qty 8)		343-0123-000	
14	Terminal, lug		304-0014-000	
15	Nut, hex, 2-56 (AP)		313-0037-000	
16	Washer, lock, 0.088 x 0.172 (AP)		310-0275-000	
17	Screw, pfh, 2-56 x 1/4 (AP)		342-0133-000	
	Harness, wiring	A,E,J	618-5439-001	
	Harness, wiring	C,F,K, N,P	618-5439-003	
	Harness, wiring	B,G,L	618-5439-002	
	Harness, wiring	D,H,N	618-5439-004	
18	Connector, rcpt, elec J1	A,C,E, F,J,K, N,P	371-2051-000	
18	Connector, rcpt, elec J1 (eff to REV D, SB 3)	B,D,G, H,L,M	371-2051-000	
18	Connector, rcpt, elec J1 (eff REV D, SB 3)	B,D,G, H,L,M	371-9036-010	
19	Nut, slflkg, hex, al, 4-40 (AP) (Qty 4)		333-0605-000	
20	Screw, mach, sst, 4-40 x 5/16 (AP) (eff to Rev AE) (Qty 4)	A,C,E, F,J,K, N,P	330-2291-000	
20	Screw, mach, sst, 4-40 x 5/16 (AP) (eff REV AE) (Qty 3)	A,C,E, F,J,K, N,P	330-2291-000	
20	Screw, mach, sst, 4-40 x 1/4 (AP) (eff REV AE)	A,C,E, F,J,K, N,P	330-2290-000	
20	Screw, mach, sst, 4-40 x 5/16 (AP) (Qty 3)	B,D,G, H,L,M	330-2291-000	
20	Screw, mach, sst, 4-40 x 1/4 (AP)	B,D,G, H,L,M	330-2290-000	
21	Plate, mounting		618-5437-001	
22	Lockspring, turn (QTY 2)		012-1003-000	
23	Rivet, 3/32 x 1/8 (AP) (Qty 4)		305-1755-000	
24	Plate		618-5333-001	
25	Screw, pfh, 2-56 x 3/16 (AP) (Qty 4)		342-0132-000	
26	Post, board support (Qty 4)		618-5403-001	
27	Screw, pph, 2-56 x 5/16 (AP) (Qty 4)		343-0125-000	
28	Washer, lock, 0.088 x 0.172 (AP) (Qty 4)		310-0275-000	
29	Bracket, meter		618-5436-001	
30	Screw, pph, 2-56 x 3/16 (AP)		343-0123-000	
31	Washer, lock, 0.088 x 0.172 (AP) (Qty 4)		310-0275-000	
32	Solenoid, flag, M1		482-5174-010	
33	Nut, hex, 2-56 (AP)		313-0037-000	
34	Screw, pph, 2-56 x 3/16 (AP)		343-0123-000	
35	Switch, sens, S1		266-7120-010	
36	Screw, pfil, 2-56 x 7/16 (AP) (Qty 2)		347-0025-000	
37	Gear, output		618-5431-001	
38	Setscrew, cup, 2-56 x 15/16 (AP) (Qty 2)		328-0368-000	
39	Post, stop (Qty 2)		618-5400-001	
40	Screw, mach, sst, 0-80 x 5/32 (AP) (Qty 2)		322-0174-000	
41	Gear, potentiometer		618-5411-001	
42	Gear, stop		618-5432-001	
43	Post, stop (Qty 2)		618-5400-001	
44	Screw, mach, sst, 0-80 x 5/32 (AP) (Qty 2)		322-0174-000	
45	Gear, cluster		618-5416-001	
46	Ring, rtng (AP) (Qty 2) (eff to REV AD)		340-0112-000	
46	Ring, rtng (AP) (eff REV AD)		340-0112-000	
47	Shaft, gear (eff to REV AD)		618-5415-001	
47	Shaft, gear (eff REV AD)		634-2201-001	
48	Spacer, gearshaft (eff to REV AD)		618-5412-001	
49	Screw, pph, 2-56 x 3/16 (AP for 47-48)		343-0123-000	
50	Washer, lock, 0.088 x 0.172 (AP for 47-48)		310-0275-000	
51	Washer, flat, sst, 0.093 x 0.250 (AP for 47-48)		310-0044-000	
52	Post		618-5401-001	
53	Post (Qty 3)		618-5402-002	
54	Screw, pph, 4-40 x 3/8 (AP for 52-53) (Qty 3)		343-0135-000	
55	Washer, lock, 0.115 x 0.209 (AP for 52-53)(Qty 3)		310-0279-000	
56	Screw, pfh, 4-40 x 3/8 (AP for 53)		342-0046-000	
57	Knob, ALT SET		763-5541-002	
58	Setscrew, cup, 4-40 x 1/8 (AP) (Qty 2)		328-5020-000	
59	Knob		763-5541-003	
59A	Bearing, sleeve		609-4894-001	
60	Indicator, decision height, DS1		262-1359-010	
60A	Lens, DH		262-1359-020	
61	Lamp		262-2732-000	
62	Cover, lamp access	A,B,C, D,J,H, L,M,N, P	618-4084-001	
62	Cover, lamp access	E,F,G, H	618-4084-003	
63	Screw (AP) (Qty 2)	A,B,C, D,J,K, L,M,N, P	618-4089-001	
64	Board assy, light (eff to SB 1)	A,B	618-4088-001	
64	Board assy, light (eff SB 1 to REV V)	A,B	618-4088-002	
64	Board assy, light (eff REV V)	A,B	618-4088-006	
64	Board assy, light (eff to REV V)	C,N	618-4088-002	
64	Board assy, light (eff REV V)	C,N	618-4088-007	
64	Board assy, light	E,G,J,L	618-4088-006	
64	Board assy, light	D,F,H, K,M,P	618-4088-007	
64A	Filter, lamp, blue/white (Qty 4) (eff REV D, -001 status)	A,B	262-1296-090	
64A	Filter, lamp, blue/white (Qty 4) (eff REV B -002 status)		262-1296-090	
64A	Filter, lamp, blue/white (Qty 4) (-006, -007 status)		262-1296-090	
65	Lamp, incand 496 (Qty 4) (Eff to REV D on -001 status)	A,B	262-1101-010	
65	Lamp, incand 6838 (Qty 4) (eff REV D on -001 status)		262-2732-000	
65	Lamp, incand 495 (Qty 4) (eff to REV B -002 status)		262-1101-000	
65	Lamp, incand (Qty 4)(eff REV B -002 status)		262-1095-000	
65	Lamp, incand 6838 (Qty 4) (-006 status)		262-2732-000	

SYMBOL	DESCRIPTION	USED ON CODE	COLLINS PART NUMBER	LOC
65	Lamp, incand (Qty 4) (-007 status)		262-1095-000	
66	Board (-001 and -002 statuses)		618-3522-001	
67	Bezel	A,B,C,D	797-7886-001	
67	Bezel	N	797-7886-004	
67	Bezel	E,F,G,H	797-7886-002	
67	Bezel	H,J,K,L,M	797-7886-003	
67	Bezel	P	797-7886-005	
67A	Mask (eff REV G)	A,B,C	621-1520-001	
67	Mask	N	621-1520-001	
68	Wedge, lighting		192-2071-030	
69	Mask, bezel		618-4071-001	
70	Bezel, instrument (eff to REV F)	A,B,C	618-5804-001	
71	Symbol, corporate	A,B,C	621-1145-001	
72	Bezel	A,B,C	618-4073-001	
73	Bezel, instrument (eff REV F)	A,B,C	618-4073-001	
73	Bezel, instrument	N	618-4073-004	
74	Not used			
75	Not used			
76	Mask, display	A,C,E,F,J,K,N,P	621-1433-001	
76	Mask, display	B,D,G,H,L,M	618-5423-001	
77	Screw, mach stl, 0-80 x 3/8 (AP) (Qty 2)		330-5003-050	
78	Spacer, sleeve		618-5435-002	
78A	Spacer, sleeve (eff to REV E)	A,B,C	618-5435-002	
78A	Spacer, dial (eff REV E)	A,B,C	621-8316-001	
78A	Spacer, dial	D,E,F,G,H,J,K,L,M,N,P	621-8316-001	
79	Spacer, sleeve		618-5435-001	
80	Pointer, attitude		618-5420-001	
81	Screw brs, 0-80 x 1/16 (AP) (Qty 2)		330-2456-000	
82	Dial, altitude	A,C,E,F,J,K,N,P	618-5425-001	
82	Dial, altitude	B,D,G,H,L,M	618-5337-001	
83	Bushing, dial		618-5426-001	
84	Mask, background		618-5424-001	
85	Screw brs, 0-80 x 1/16 (AP) (Qty 3)		330-2456-000	
86	Disk, cam-staked		618-5438-001	
86A	Setscrew, oval, 2-56 x 3/16 (Qty 2) (eff to REV S)		335-0233-000	
86A	Setscrew, 2-56 x 3/16 (Qty 2) (eff REV S)		335-0123-000	
87	Hub, cam, disk		618-5419-001	
88	Setscrew, oval, 2-56 x 3/16 (Qty 2) (eff to REV B)		335-0233-000	
89	Disk, cam		618-5418-001	
90	Cam follower-rolled		618-5433-001	
91	Screw, 0-80 x 1/8 (AP) (Qty 2)		330-5003-010	
92	Bushing, actuator, switch		618-5408-001	
93	Follower, cam		618-5417-001	
94	Rivet, 1/16 x 3/32 (AP) (Qty 2)		305-1710-000	
95	Spring, cam-follower		618-5407-001	
96	Washer, special (eff to REV M)	A,B,C	553-5004-003	
96	Washer, special (eff REV M)	A,B,C	756-8204-011	
96	Washer, special	D,E,F,G,H,J,K,L,M,N,P	756-8204-011	
97	Spring, actuator		618-5406-001	
98	Post, actuator-switch		618-5398-001	
99	Screw, 0-80 x 1/8 (AP for 97-98) (Qty 3)		330-5003-010	
100	Stop, plate (Qty 2)	A,C,E,F,J,K,N,P	618-5397-001	
100	Stop, plate	B,D,G,H,L,M	618-5397-001	
101	Screw, mach, 0-80 x 3/16 (AP) (Qty 4)	A,C,E,F,J,K,N,P	322-0169-000	
101	Screw, mach, 0-80 x 3/16 (AP) (Qty 2)	B,D,G,H,L,M	322-0169-000	
102	Res, var, 2kΩ, 10%, 1W, R1	A,C,E,F,J,K	382-0039-020	
102	Res, var, 2kΩ, 10%, 1W, R1	B,D,G,H,L,M	382-0039-010	
103	Screw, pph, 2-56 x 3/16 (AP) (Qty 2)		343-0123-000	
104	Washer, lock, 0.088 x 0.172 (AP) (Qty 2)		310-0275-000	
105	Washer, flat, sst, 0.093 x 0.250 (AP) (Qty 2)		310-0044-000	
106	Plate, bearing		618-5404-001	
107	Nut, hex, 2-56 (AP) (Qty 4)		313-0037-000	
108	Washer, lock, 0.088 x 0.172 (AP) (Qty 4)		310-0275-000	
109	Washer, flat, 0.092 x 0.218 (AP) (Qty 4)		310-6320-000	
110	Screw, pfh, 2-56 x 7/8 (AP) (Qty 4)		342-0139-000	
111	Spacer, sleeve (Qty 2)		775-5069-001	
112	Bracket, guide		618-5405-001	
113	Marker, decision height		618-5414-001	
114	Screw, mach, stl, 0-80 x 1/4 (AP) (Qty 2)		330-5003-030	
115	Gear, decision height-switch		618-5391-001	
116	Gear		618-5392-001	
117	Ring, rtng (AP (Qty 2)		340-0112-000	
118	Post, gear		618-5395-001	
119	Ring, rtng (AP)		340-0112-000	
120	Post (Qty 5)		618-5399-001	
121	Screw, pph, 2-56 x 1/4 (AP) (Qty 5)		343-0124-000	
122	Washer, lock, 0.088 x 0.172 (AP) (Qty 5)		310-0275-000	
123	Plate, gear		618-5422-001	
124	Gearshaft		775-5120-001	
125	Bearing, ball, (AP) (Qty 2)		309-1557-000	
126	Gearshaft		775-5119-001	
127	Bearing, ball, (AP) (Qty 2)		309-1557-000	
	Clutch assembly (consists of items 128-134)		618-5430-001	
128	Gearshaft, clutch		618-5409-001	
129	Collar, clutch		618-5413-001	
130	Setscrew, cup, 0-80 x 1/8 (AP) (Qty 2)		328-0373-000	
131	Gear		618-5410-001	
132	Ring, rtng (Qty 2)		340-0112-000	
133	Washer, tension		618-5429-001	
134	Bearing, ball,		309-1561-000	
135	Washer, tension		797-6939-002	
136	Bearing, ball,		309-1561-000	
137	Shaft, knob, pinned		618-5427-001	
138	Pin, spring, sst, 0.031 dia x 1/8		311-0430-000	
139	Gear		618-5392-001	
140	Shaft		618-5393-001	
141	Nut, slflkg, hex, al, 4-40 (AP)		333-0605-000	
142	Washer, flat, .312 dia, .025 thk (AP) (Qty 2)		310-0045-000	
143	Washer, spring tension, 0.130 x 0.037 (eff to Rev T)		310-0154-000	
143	Washer, spring tension,0.130 x 0.037 (Qty 2) (eff REV T)		310-0154-000	
144	Washer, special		553-5004-003	
145	Bushing		618-5394-001	
145A	Cap, cer, 0.01µF, 10%, 100V C8 (eff SB 3)	A,C,N	913-5019-200	
145A	Cap, cer, 0.01µF, 10%, 100V C8 (eff SB 4)	B	913-5019-200	
145A	Cap, cer, 0.01µF, 10%, 100V C8	D,E,F,G,H,J,K,L,M,P	913-5019-200	
145B	Cap, cer, 0.01µF, 10%, 100V C9 (eff SB 3)	A,C,N	913-5019-200	
145B	Cap, cer, 0.01µF, 10%, 100V C9 (eff SB 4)	B	913-5019-200	
145B	Cap, cer, 0.01µF, 10%, 100V C9	D,E,F,G,H,J,K,L,M,P	913-5019-200	
146	Motor, dc B1 (eff to REV E)	A,B,C	230-0303-010	
146	Motor, dc B1 (eff REV E TO REV AF))	A,B,C	230-0303-000	
146	Motor, dc B1 (eff REV L to REV AF)	D,E,F,G,H,J,K,L,M,N,P	230-0303-000	
146	Motor, dc B1 (eff REF AF)		230-0303-050	
147	Screw, pph, 2-56 x 5/16 (AP) (Qty 2)		343-0125-000	
148	Washer, lock, 0.088 x 0.172 (AP) (Qty 2)		310-0275-000	
149	Shaft, extension, switch		609-4764-002	
150	Gasket (AP)		220-0224-000	
151	Button, actr S2		266-7056-000	
152	Bushing, sleeve (AP)		609-4759-001	
153	Plate, motor		618-5428-001	
154	Spacer, sleeve (Qty 2)		775-5069-001	
155	Plate, retaining		618-5421-001	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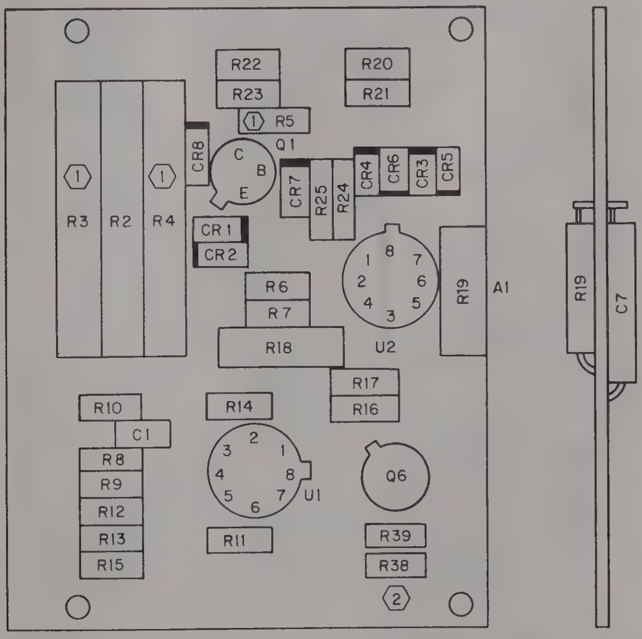
TP3-5736-014

339H-4/4A Radio Altitude Indicator, Exploded View
Figure 1

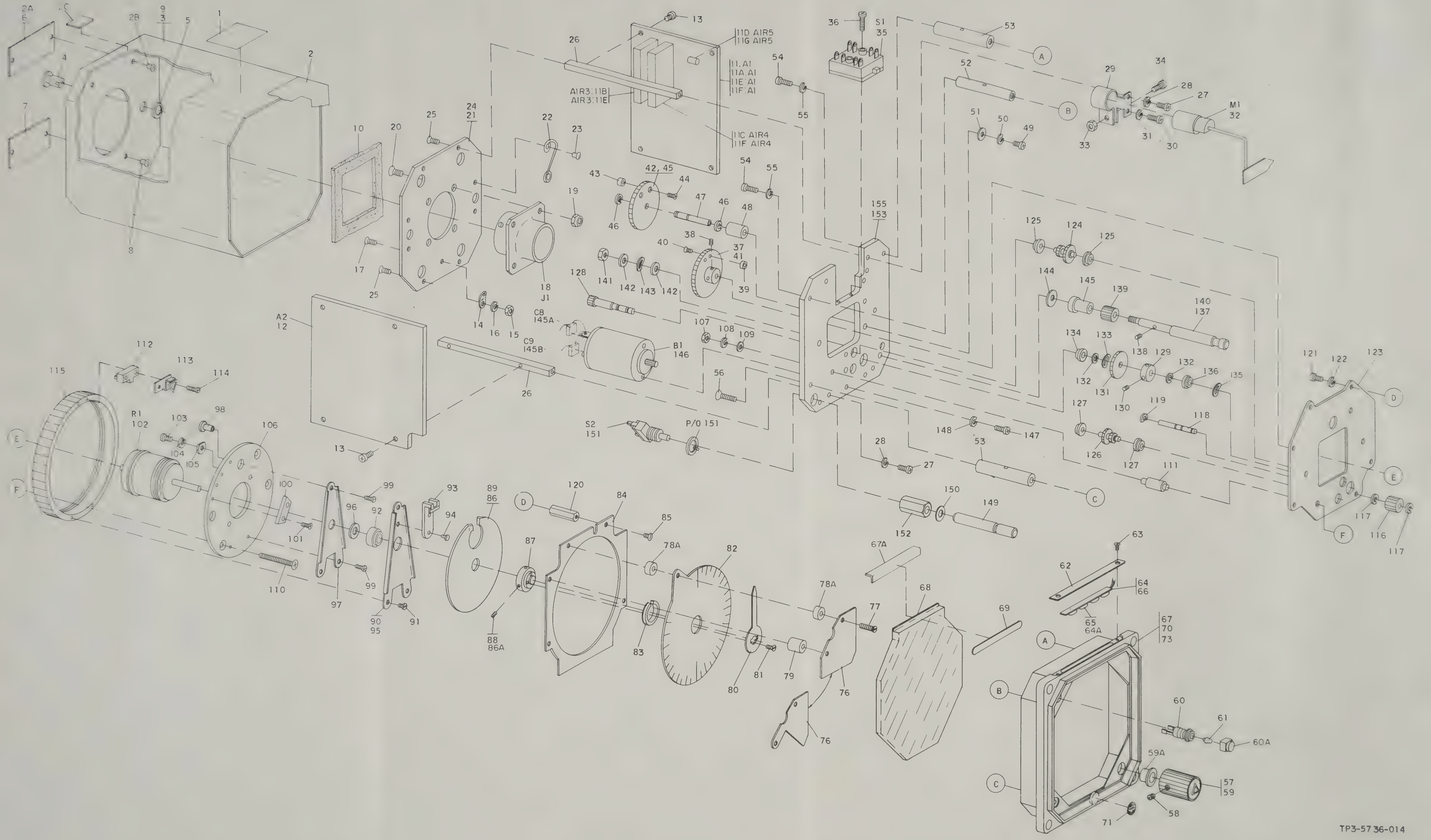
PARTS LIST
CIRCUIT CARD ASSEMBLY A1 (CPN 618-3690-001/002)

SYMBOL	DESCRIPTION	USED ON CODE	COLLINS PART NUMBER	LOC
A1	Circuit card assembly A1	A	618-3690-001	
A1	Circuit card assembly A1	B	618-3690-002	
C1	Cap, cer, 0.1μF, 20%, 50V		913-5019-720	
C2-				
C6	Not used			
C7	Cap, elctlt, 2.3μF, 20%, 35V (eff REV C, SB 2)		184-8268-000	
CR1	Diode, 1N4454		353-3644-010	
CR2	Diode, 1N4454		353-3644-010	
CR3	Diode, 1N4454		353-3644-010	
CR4	Diode, 1N4454		353-3644-010	
CR5	Diode, 1N4454		353-3644-010	
CR6	Diode, 1N4454		353-3644-010	
CR7	Diode, 1N4454		353-3644-010	
CR8	Diode, 1N4454		353-3644-010	
Q1	Transistor, npn, 2N2222A		352-0661-020	
Q2-				
Q5	Not used			
Q6	Transistor, pnp, 2N3910 (eff REV H)	A	352-0692-010	
Q6	Transistor, pnp, 2N3910 (eff REV K)	B	352-0692-010	
R1	Not used			
R2	Res, var, 500Ω, 5%, 3/4W		381-1798-000	
R3-				
R6	Not used			
R7	Res, mf, 1.8kΩ, 1%, 1/8W		705-6032-030	
R8	Res, mf, 205kΩ, 1%, 1/8W (eff to REV N)		705-6036-020	
R8	Res, mf, 205kΩ, 1%, 1/8W (eff REV N)		705-1107-000	
R9	Res, mf, 158kΩ, 1%, 1/8W (eff to REV N)		705-6035-790	
R9	Res, mf, 158kΩ, 1%, 1/8W (eff REV N)		705-3604-100	
R10	Res, mf, 205kΩ, 1%, 1/8W (eff to REV N)		705-6036-020	
R10	Res, mf, 205kΩ, 1%, 1/8W (eff REV N)		705-1107-000	
R11	Res, mf, 205kΩ, 1%, 1/8W (eff to REV N)		705-6036-020	
R11	Res, mf, 205kΩ, 1%, 1/8W (eff REV N)		705-1107-000	
R12	Res, mf, 154kΩ, 1%, 1/8W (eff to REV N)		705-6035-770	
R12	Res, mf, 154kΩ, 1%, 1/8W (eff REV N)		705-1101-000	
R13	Res, mf, 205kΩ, 1%, 1/8W (eff to REV N)		705-6036-020	
R13	Res, mf, 205kΩ, 1%, 1/8W (eff REV N)		705-1107-000	
R14	Res, mf, 154kΩ, 1%, 1/8W (eff to REV N)		705-6035-770	
R14	Res, mf, 154kΩ, 1%, 1/8W (eff REV N)		705-1101-000	
R15	Res, mf, 154kΩ, 1%, 1/8W (eff to REV N)		705-6035-770	
R15	Res, mf, 154kΩ, 1%, 1/8W (eff REV N)		705-1101-000	
R16	Res, mf, 10kΩ, 1%, 1/8W (eff to REV N)		705-6033-470	
R16	Res, mf, 10kΩ, 1%, 1/8W (eff REV N)		705-1044-000	
R17	Res, mf, 10kΩ, 1%, 1/8W (eff to REV N)		705-6033-470	
R17	Res, mf, 10kΩ, 1%, 1/8W (eff REV N)		705-1044-000	
R18	Res, mf, 1MΩ, 1%, 1/4W		705-6740-000	
R19	Res, mf, 1MΩ, 1%, 1/4W		705-6740-000	
R20	Res, cc, 10kΩ, 1%, 1/8W (eff to REV N)		705-6033-470	
R20	Res, mf, 10kΩ, 1%, 1/8W (eff REV N)		705-1044-000	
R21	Res, mf, 10kΩ, 1%, 1/8W (eff to REV N)		705-6033-470	
R21	Res, mf, 10kΩ, 1%, 1/8W (eff REV N)		705-1044-000	
R22	Res, mf, 30.1Ω, 1%, 1/8W		705-6034-400	
R23	Res, mf, 30.1Ω, 1%, 1/8W		705-6034-400	
R24	Res, cc, 10kΩ, 10%, 1/4W		745-0785-000	
R25	Res, cc, 10kΩ, 10%, 1/4W		745-0785-000	
R26-				
R37	Not used			
R38	Res, mf, 63.4kΩ, 1%, 1/8W (eff REV H to SB 6)	A	705-3605-860	
R38	Res, mf, 64.9kΩ, 1%, 1/8W (eff SB 6)	A	705-1083-000	
R38	Res, mf, 56.2kΩ, 1%, 1/8W (eff REV K to REV M)	B	705-1080-000	
R38	Res, mf, 63.4kΩ, 1%, 1/8W (eff REV M SB 5)	B	705-3605-860	
R39	Res, mf, 100kΩ, 1%, 1/8W (eff REV H)	A	705-1092-000	
R39	Res, mf, 100kΩ, 1%, 1/8W (eff REV K)	B	705-1092-000	
U1	IC, 2x op amp 1458 (eff to REV F)		351-1071-060	
U1	IC, 2x op amp 1558 (eff REV F)		351-1071-020	
U2	IC, 2x op amp 1458 (eff to REV F)		351-1071-060	
U2	IC, 2x op amp 1558 (eff REV F)		351-1071-020	
	Contact, elec (eff REV C, SB 2)		372-2601-050	



TP6-3652-013

Circuit Card Assembly A1 (CPN 618-3690-001, -002),
Component Location Diagram
Figure 2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A1R3:11B
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11C A1R4
11F A1R4
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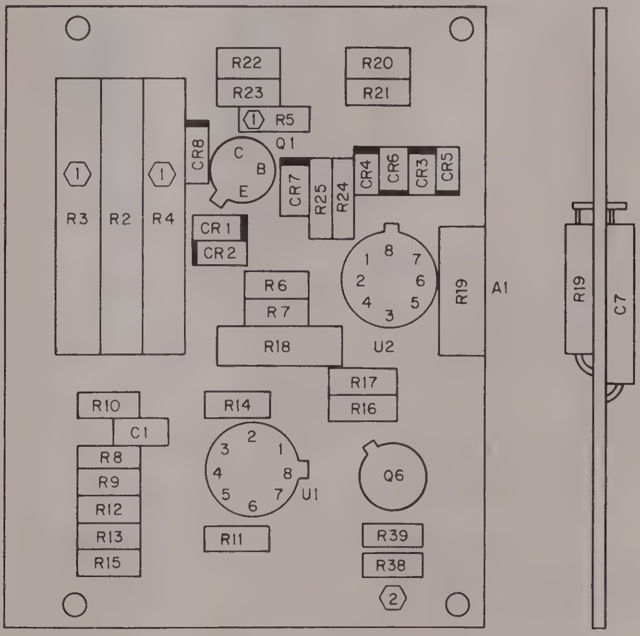
TP3-5736-014

339H-4/4A Radio Altitude Indicator, Exploded View
Figure 1

PARTS LIST
CIRCUIT CARD ASSEMBLY A1 (CPN 618-3690-001/002)

SYMBOL	DESCRIPTION	USED ON CODE	COLLINS PART NUMBER	LOC
A1	Circuit card assembly A1	A	618-3690-001	
A1	Circuit card assembly A1	B	618-3690-002	
C1	Cap, cer, 0.1μF, 20%, 50V		913-5019-720	
C2-C6	Not used			
C7	Cap, elctlt, 2.3μF, 20%, 35V (eff REV C, SB 2)		184-8268-000	
CR1	Diode, 1N4454		353-3644-010	
CR2	Diode, 1N4454		353-3644-010	
CR3	Diode, 1N4454		353-3644-010	
CR4	Diode, 1N4454		353-3644-010	
CR5	Diode, 1N4454		353-3644-010	
CR6	Diode, 1N4454		353-3644-010	
CR7	Diode, 1N4454		353-3644-010	
CR8	Diode, 1N4454		353-3644-010	
Q1	Transistor, npn, 2N2222A		352-0661-020	
Q2-Q5	Not used			
Q6	Transistor, pnp, 2N3910 (eff REV H)	A	352-0692-010	
Q6	Transistor, pnp, 2N3910 (eff REV K)	B	352-0692-010	
R1	Not used			
R2	Res, var, 500Ω, 5%, 3/4W		381-1798-000	
R3-R6	Not used			
R7	Res, mf, 1.8kΩ, 1%, 1/8W		705-6032-030	
R8	Res, mf, 205kΩ, 1%, 1/8W (eff to REV N)		705-6036-020	
R8	Res, mf, 205kΩ, 1%, 1/8W (eff REV N)		705-1107-000	
R9	Res, mf, 158kΩ, 1%, 1/8W (eff to REV N)		705-6035-790	
R9	Res, mf, 158kΩ, 1%, 1/8W (eff REV N)		705-3604-100	
R10	Res, mf, 205kΩ, 1%, 1/8W (eff to REV N)		705-6036-020	
R10	Res, mf, 205kΩ, 1%, 1/8W (eff REV N)		705-1107-000	
R11	Res, mf, 205kΩ, 1%, 1/8W (eff to REV N)		705-6036-020	
R11	Res, mf, 205kΩ, 1%, 1/8W (eff REV N)		705-1107-000	
R12	Res, mf, 154kΩ, 1%, 1/8W (eff to REV N)		705-6035-770	
R12	Res, mf, 154kΩ, 1%, 1/8W (eff REV N)		705-1101-000	
R13	Res, mf, 205kΩ, 1%, 1/8W (eff to REV N)		705-6036-020	
R13	Res, mf, 205kΩ, 1%, 1/8W (eff REV N)		705-1107-000	
R14	Res, mf, 154kΩ, 1%, 1/8W (eff to REV N)		705-6035-770	
R14	Res, mf, 154kΩ, 1%, 1/8W (eff REV N)		705-1101-000	
R15	Res, mf, 154kΩ, 1%, 1/8W (eff to REV N)		705-6035-770	
R15	Res, mf, 154kΩ, 1%, 1/8W (eff REV N)		705-1101-000	
R16	Res, mf, 10kΩ, 1%, 1/8W (eff to REV N)		705-6033-470	
R16	Res, mf, 10kΩ, 1%, 1/8W (eff REV N)		705-1044-000	
R17	Res, mf, 10kΩ, 1%, 1/8W (eff to REV N)		705-6033-470	
R17	Res, mf, 10kΩ, 1%, 1/8W (eff REV N)		705-1044-000	
R18	Res, mf, 1MΩ, 1%, 1/4W		705-6740-000	
R19	Res, mf, 1MΩ, 1%, 1/4W		705-6740-000	
R20	Res, cc, 10kΩ, 1%, 1/8W (eff to REV N)		705-6033-470	
R20	Res, mf, 10kΩ, 1%, 1/8W (eff REV N)		705-1044-000	
R21	Res, mf, 10kΩ, 1%, 1/8W (eff to REV N)		705-6033-470	
R21	Res, mf, 10kΩ, 1%, 1/8W (eff REV N)		705-1044-000	
R22	Res, mf, 30.1Ω, 1%, 1/8W		705-6034-400	
R23	Res, mf, 30.1Ω, 1%, 1/8W		705-6034-400	
R24	Res, cc, 10kΩ, 10%, 1/4W		745-0785-000	
R25	Res, cc, 10kΩ, 10%, 1/4W		745-0785-000	
R26-R37	Not used			
R38	Res, mf, 63.4kΩ, 1%, 1/8W (eff REV H to SB 6)	A	705-3605-860	
R38	Res, mf, 64.9kΩ, 1%, 1/8W (eff SB 6)	A	705-1083-000	
R38	Res, mf, 56.2kΩ, 1%, 1/8W (eff REV K to REV M)	B	705-1080-000	
R38	Res, mf, 63.4kΩ, 1%, 1/8W (eff REV M SB 5)	B	705-3605-860	
R39	Res, mf, 100kΩ, 1%, 1/8W (eff REV H)	A	705-1092-000	
R39	Res, mf, 100kΩ, 1%, 1/8W (eff REV K)	B	705-1092-000	
U1	IC, 2x op amp 1458 (eff to REV F)		351-1071-060	
U1	IC, 2x op amp 1558 (eff REV F)		351-1071-020	
U2	IC, 2x op amp 1458 (eff to REV F)		351-1071-060	
U2	IC, 2x op amp 1558 (eff REV F)		351-1071-020	
	Contact, elec (eff REV C, SB 2)		372-2601-050	

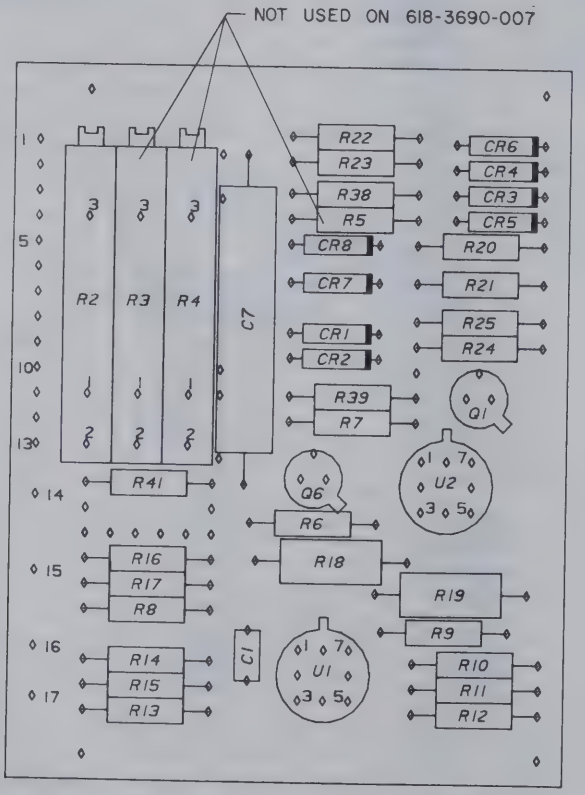


TP6-3652-013

Circuit Card Assembly A1 (CPN 618-3690-001, -002), Component Location Diagram
Figure 2

PARTS LIST
CIRCUIT CARD ASSEMBLY A1 (CPN 618-3690-005/007)

SYMBOL	DESCRIPTION	USED ON CODE	COLLINS PART NUMBER	LOC
A1	Circuit card assembly	A	618-3690-005	
A1	Circuit card assembly	B	618-3690-007	
C1	Cap, cer, 0.1μF, 20%, 50V		913-5019-720	
C2-C6	Not used			
C7	Cap, elctlt, 2.3μF, 20%, 35V		184-8268-000	
CR1	Diode, 1N4454		353-3644-010	
CR2	Diode, 1N4454		353-3644-010	
CR3	Diode, 1N4454		353-3644-010	
CR4	Diode, 1N4454		353-3644-010	
CR5	Diode, 1N4454		353-3644-010	
CR6	Diode, 1N4454		353-3644-010	
CR7	Diode, 1N4454		353-3644-010	
CR8	Diode, 1N4454		353-3644-010	
Q1	Transistor, npn, 2N2222A		352-0661-020	
Q2-Q5	Not used			
Q6	Transistor, pnp, 2N3910		352-0692-010	
R1	Not used			
R2	Res, var, 500Ω		381-1798-000	
R3	Res, var, 500Ω, 10%, 1/4W	A	380-3773-020	
R3	Not used	B		
R4	Res, var, 50Ω, 5%, 1/2W	A	381-1272-000	
R4	Not used	B		
R5	Res, cc, 6.8kΩ, 10%, 1/4W	A	745-0779-000	
R5	Not used	B		
R6	Res, mf, 1.8kΩ, 1%, 1/8W		705-6032-030	
R7	Res, mf, 1.8kΩ, 1%, 1/8W		705-6032-030	
R8	Res, mf, 205kΩ, 1%, 1/8W		705-1107-000	
R9	Res, mf, 158kΩ, 1%, 1/8W		705-3604-100	
R10	Res, mf, 205kΩ, 1%, 1/8W		705-1107-000	
R11	Res, mf, 205kΩ, 1%, 1/8W		705-1107-000	
R12	Res, mf, 154kΩ, 1%, 1/8W		705-1101-000	
R13	Res, mf, 205kΩ, 1%, 1/8W		705-1107-000	
R14	Res, mf, 154kΩ, 1%, 1/8W		705-1101-000	
R15	Res, mf, 154kΩ, 1%, 1/8W		705-1101-000	
R16	Res, mf, 10kΩ, 1%, 1/8W		705-1044-000	
R17	Res, mf, 10kΩ, 1%, 1/8W		705-1044-000	
R18	Res, mf, 1MΩ, 1%, 1/4W		705-6740-000	
R19	Res, mf, 1MΩ, 1%, 1/4W		705-6740-000	
R20	Res, mf, 10kΩ, 1%, 1/8W		705-1044-000	
R21	Res, mf, 10kΩ, 1%, 1/8W		705-1044-000	
R22	Res, mf, 30.1kΩ, 1%, 1/8W		705-1067-000	
R23	Res, mf, 30.1kΩ, 1%, 1/8W		705-1067-000	
R24	Res, cc, 10kΩ, 10%, 1/4W		745-0785-000	
R25	Res, cc, 10kΩ, 10%, 1/4W		745-0785-000	
R26-R37	Not used			
R38	Res, mf, 63.4kΩ, 1%, 1/8W	A	705-3605-860	
R38	Res, mf, 64.9kΩ, 1%, 1/8W	B	705-1083-000	
R39	Res, mf, 100kΩ, 1%, 1/8W		705-1092-000	
R40	Not used	A		
R40	Res, 0.0Ω	B	428-0289-010	
R41	Res, 0.0Ω	A	428-0289-010	
R41	Not used	B		
U1	IC, 2x op amp 1558		351-1071-020	
U2	IC, 2x op amp 1558		351-1071-020	

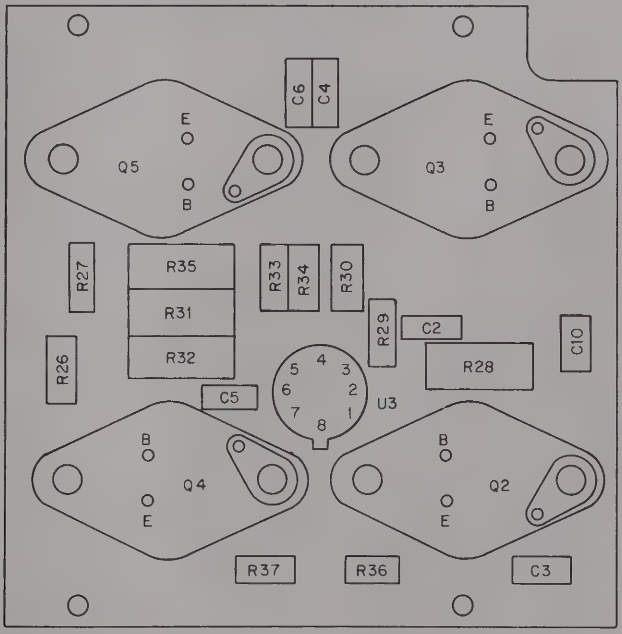


TP6-3650-013

Circuit Card Assembly A1 (CPN 618-3690-005, -007), Component Location Diagram
Figure 3

PARTS LIST
CIRCUIT CARD ASSEMBLY A2 (CPN 618-3691-001)

SYMBOL	DESCRIPTION	USED ON CODE	COLLINS PART NUMBER	LOC
A2	Circuit card assembly A2		618-3691-001	
C1	Not used			
C2	Cap, cer, 0.1μF, 20%, 50V		913-5019-720	
C3	Cap, cer, 0.01μF, 20%, 100V		913-5019-660	
C4	Cap, cer, 0.01μF, 20%, 100V		913-5019-660	
C5	Cap, cer, 0.01μF, 20%, 100V		913-5019-660	
C6	Cap, cer, 0.01μF, 20%, 100V		913-5019-660	
C7-				
C9	Not used			
C10	Cap, cer, 0.47μF, 20%, 50V (eff REV G)		913-3279-250	
	SB 4 on 339H-4, SB 5 on 339H-4A			
Q1	Not used			
Q2	Transistor, npn, 2N3054		352-0581-010	
	Nut, hex, 4-40 (AP) (Qty 2)		313-0132-000	
	Washer, lock, 0.124 x 0.275 (AP Q2) (Qty 2)		373-0154-000	
	Terminal, lug (AP)		304-0015-000	
	Plate, mounting (AP)		352-9586-020	
	Screw, pph, 4-40 x 1/4 (AP) (Qty 2)		343-0133-000	
Q3	Transistor, pnp, 2N3741		352-0695-020	
	Nut, hex, 4-40 (AP) (Qty 2)		313-0132-000	
	Washer, lock, 0.124 x 0.275 (AP Q3) (Qty 2)		373-0154-000	
	Terminal, lug (AP)		304-0015-000	
	Plate, mounting (AP)		352-9586-020	
	Screw, pph, 4-40 x 1/4 (AP) (Qty 2)		343-0133-000	
Q4	Transistor, npn, 2N3054		352-0581-010	
	Nut, hex, 4-40 (AP) (Qty 2)		313-0132-000	
	Washer, lock, 0.124 x 0.275 (AP) (Qty 2)		373-0154-000	
	Terminal, lug (AP)		304-0015-000	
	Plate, mounting (AP)		352-9586-020	
	Screw, pph, 4-40 x 1/4 (AP) (Qty 2)		343-0133-000	
Q5	Transistor, pnp, 2N3741		352-0695-020	
	Nut, hex, 4-40 (AP) (Qty 2)		313-0132-000	
	Washer, lock, 0.124 x 0.275 (AP) (Qty 2)		373-0154-000	
	Terminal, lug (AP)		304-0015-000	
	Plate, mounting (AP)		352-9586-020	
	Screw, pph, 4-40 x 1/4 (AP) (Qty 2)		343-0133-000	
	Insulator, xstr (AP Q5)		352-9605-110	
R1-				
R25	Not used			
R26	Res, cc, 4.7kΩ, 10%, 1/4W		745-0773-000	
R27	Res, cc, 390Ω, 5%, 1/4W		745-0733-000	
R28	Res, mf, 1MΩ, 1%, 1/4W		705-6740-000	
R29	Res, mf, 2.49kΩ, 1%, 1/8W (eff to REV H)		705-6032-300	
R29	Res, mf, 2.49kΩ, 1%, 1/8W (eff REV H)		705-1015-000	
R30	Res, mf, 2.49kΩ, 1%, 1/8W (Eff To REV H)		705-6032-600	
R30	Res, mf, 2.49kΩ, 1%, 1/8W (eff REV H)		705-1015-000	
R31	Res, mf, 1MΩ, 1%, 1/4W		705-6740-000	
R32	Res, mf, 1MΩ, 1%, 1/4W		705-6740-000	
R33	Res, mf, 2.49kΩ, 1%, 1/8W (eff to REV H)		705-6032-300	
R33	Res, mf, 2.49kΩ, 1%, 1/8W (eff REV H)		705-1015-000	
R34	Res, mf, 2.49kΩ, 1%, 1/8W (eff to REV H)		705-6032-300	
R34	Res, mf, 2.49kΩ, 1%, 1/8W (eff REV H)		705-1015-000	
R35	Res, mf, 1MΩ, 1%, 1/4W		705-6740-000	
R36	Res, mf, 100Ω, 1%, 1/8W (eff to REV H)		705-6029-590	
R36	Res, mf, 100Ω, 1%, 1/8W (eff REV H)		705-0948-000	
R37	Res, mf, 100Ω, 1%, 1/8W (eff to REV H)		705-6029-590	
R37	Res, mf, 100Ω, 1%, 1/8W (eff REV H)		705-0948-000	
U1-				
U2	Not used			
U3	IC, 2x op amp 1558		351-1071-020	



TP6-3644-013

Circuit Card Assembly A2 (CPN 618-3691-001),
Component Location Diagram
Figure 4

Bulletins

339H-4/4A

523-0775347-001118

Collins 339H-4/4A Radio Altitude Indicator

Rockwell International

bulletins

Collins General Aviation Division

Printed in USA

•523-0775347-001118
1st Edition, 15 January 1988

Service Bulletins and Service Information Letters

(Refer to latest edition/addendum of the General Aviation Equipment Service Bulletin/Information Letter Index 523-0766944 for up-to-date listing.)

SB/SIL Number	*Unit*	*Title*	*Date*
1	339H-4/4A	Convert From 28-Volt to 5-Volt Lighting	Apr 1/73
1R1			Sep 1/73
1R2			Dec 1/73
2	339H-4/4A	Preventing False Altitude Trip Indications Above 2500 Feet	Mar 15/74
2R1			Sep 30/74
3	339H-4	Prevent Brush Noise in Servo Motor	Jun 13/75
3	339H-4A	Protect From Internal RFI	Sep 9/74
4	339H-4	Prevent Servo-Amplifier Oscillation	Jun 30/75
4R1			Jan 5/76
4	339H-4A	Prevent Brush Noise in Servo Motor	Jun 13/75
5	339H-4	Prevent Gear Wear by Adding New ALT Clamp Circuit	Mar 1/78
5R1			Apr 30/80
5R2			Apr 22/85
5	339H-4A	Prevent Servo-Amplifier Oscillation	Jun 30/75
6	339H-4	Protect From External RFI	Aug 15/78
6	339H-4A	Prevent Gear Wear by Adding New ALT Clamp Circuit	Nov 15/78
6R1			Jun 15/79

Collins 339H-4/4A Radio Altitude Indicator

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International

appendix

Collins General Aviation Division
Printed in USA
●523-0775278-001118
1st Edition, 15 January 1988

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Description	*Pages*
Integrated Circuit Descriptions	1 through 2

Appendix

339H-4/4A Radio Altitude Indicator

523-0775278-001118

List of Effective Pages

*The asterisk indicates pages changed, added, or deleted by the current change.

Page No	Issue
Title	15 Jan 88
List of Effective Pages	15 Jan 88
1 thru 2	15 Jan 88

Record of Revisions

RETAIN THIS RECORD IN THE FRONT OF MANUAL.
ON RECEIPT OF REVISIONS, INSERT REVISED PAGES IN THE MANUAL, AND ENTER DATE INSERTED AND INITIALS.

REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED	REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED
1st Ed	15 Jan 88		None				

appendix

INTEGRATED CIRCUIT DESCRIPTIONS

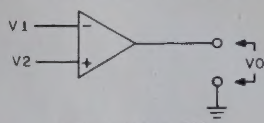
Several types types of IC's are used within the 339H-4/4A to enable the unit to perform its various functions. Figure 1 contains a brief description, functional diagram, and IC logic symbol of IC's used within this unit. An index of the IC's described in this appendix follows:

FIGURE NUMBER	TYPE NUMBER	DESCRIPTION	PAGE NUMBER
1		Basic Opamp Descriptions	2

DESCRIPTION

OPERATIONAL AMPLIFIERS (OP-AMPS) ARE USED TO ADD, SUBSTRACT, AVERAGE, INTEGRATE AND COMPARE. THE OP-AMP PRODUCES AN OUTPUT WHEN THERE IS A VOLTAGE DIFFERENCE BETWEEN THE TWO INPUT TERMINALS. A POSITIVE GOING SIGNAL AT THE INVERTING INPUT PRODUCES A NEGATIVE GOING OUTPUT SIGNAL, WHEREAS A POSITIVE GOING SIGNAL AT THE NON-INVERTING INPUT PRODUCES A POSITIVE GOING OUTPUT SIGNAL. SHOWN IN FUNCTIONAL DIAGRAMS A THRU G ARE SEVERAL BASIC OP-AMP CONFIGURATIONS.

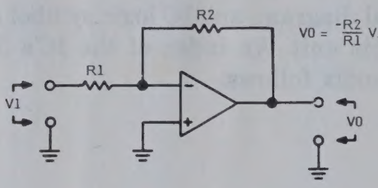
FUNCTIONAL DIAGRAM A



V 1	V2	V O
0	0	UNDEFINED
0	1	V +
1	0	V -
1	1	UNDEFINED

BASIC COMPARATOR

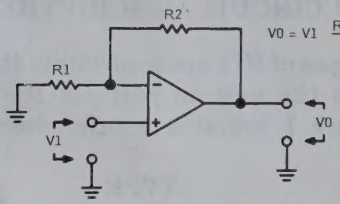
FUNCTIONAL DIAGRAM B



$V0 = \frac{-R2}{R1} V1$

INVERTING AMPLIFIER

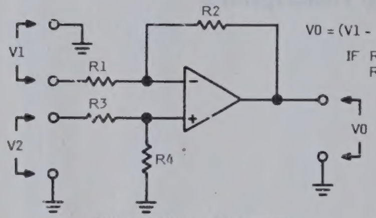
FUNCTIONAL DIAGRAM C



$V0 = V1 \frac{R1 + R2}{R1}$

NONINVERTING AMPLIFIER

FUNCTIONAL DIAGRAM D

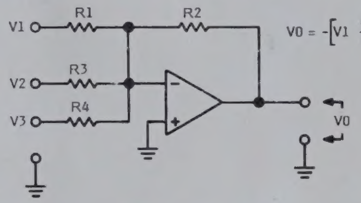


$V0 = (V1 - V2) \frac{R2}{R1}$

IF R2 = R4
R1 = R3

DIFFERENTIAL AMPLIFIER

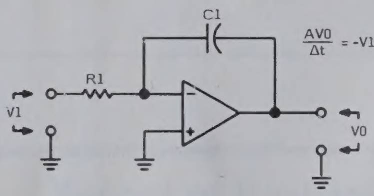
FUNCTIONAL DIAGRAM E



$V0 = -\left[V1 \frac{R2}{R1} + V2 \frac{R2}{R3} + V3 \frac{R2}{R4}\right]$

SUMMING INVERTER

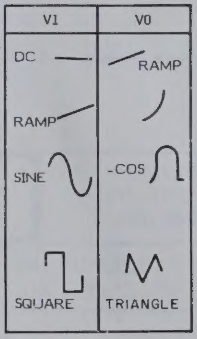
FUNCTIONAL DIAGRAM F



$\frac{\Delta V0}{\Delta t} = -V1 \frac{1}{R1C1}$

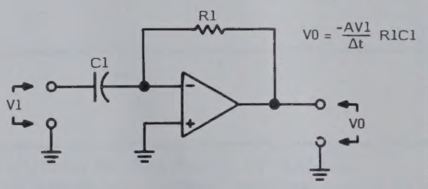
INTEGRATOR

FUNCTION TABLE



V1	V0
DC	RAMP
RAMP	
SINE	-COS
SQUARE	TRIANGLE

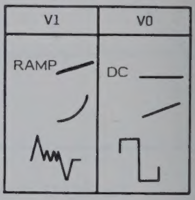
FUNCTIONAL DIAGRAM G



$V0 = \frac{-AV1}{\Delta t} R1C1$

DIFFERENTIATOR

FUNCTION TABLE

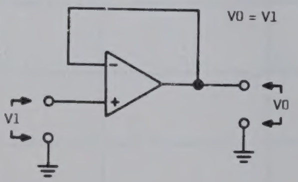


V1	V0
RAMP	DC

COMPENSATION NETWORKS

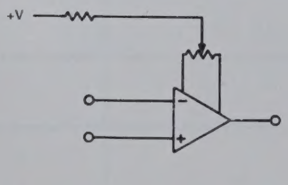
COMPENSATON NETWORKS ARE ADDED TO OP-AMP CIRCUITS TO OFFSET UNDESIRED CHARACTERISTICS. TWO EXAMPLES ARE SHOWN BELOW. OFFSET BALANCING IS REQUIRED IN SMALL SIGNAL APPLICATIONS WHERE VARIATIONS IN THE OP-AMP PARAMETERS MAY CAUSE INPUT DIFFERENCES. PHASE COMPENSATION IS ADDED TO PROVIDE CLOSED LOOP STABILITY TO THE CIRCUIT.

FUNCTIONAL DIAGRAM H

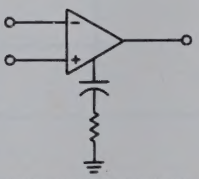


VOLTAGE FOLLOWER

FUNCTIONAL DIAGRAM I

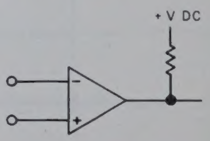


OFFSET BALANCING



PHASE COMPENSATION

FUNCTIONAL DIAGRAM J



OPEN COLLECTOR
OR
OPEN DRAIN
(ACTIVE VO = GROUND)

TP6-3693-014-1

Basic Opamp Descriptions
Figure 1

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